P2 Electricity

4.2.1 Current, potential difference and resistance	Define current as rate of flow of charge: **Current x time = charge (I x t = Q) 1 Amp = 1 coulomb per second** Current is the same at every point in a single loop (e.g. in a series circuit). SI units for charge = coulombs, time = seconds. 1 amp = 1 coulomb per second.	Green	Amber	Red
Resistance	• A potential difference (V) across a conductor causes a current (I) to flow. • The size of the current depends upon the size of the p.d (V) and the resistance (R) of the conductor. • The greater the p.d, the greater the current. • The greater the resistance, the smaller the current. • The three quantities are linked by the following equation: • **potential difference = current × resistance (V = IR)** • SI system units for all three quantities. (Volt (V), amp(A), ohm(Ω) • Conventional current flows from **positive to negative.**	Green	Amber	Red
Required practical activity 3:	Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits. This should include: • the length of a wire at constant temperature • combinations of resistors in series and parallel.	Green	Amber	Red
Resistors	Recognise the current (x axis) potential difference (V) (I/V) characteristic graphs for the following components: • An ohmic conductor (e.g. metallic wire) (Obeying ohm's law: V α I) **Constant resistance at constant temperature.** • A filament light bulb: **resistance increases with temperature** (due to increased current). • A diode (or LED): current will only flow if the applied potential difference is in the correct direction. In the reverse direction its resistance **is extremely high**. The applications of thermistors in circuits e.g. a thermostat is required. The resistance of an LDR decreases as light intensity increases. Explain the design and use of a circuit to measure the resistance of a component by measuring the current through, and potential difference across, the component Draw an appropriate circuit diagram using correct circuit symbols.	Green Green Green	Amber Amber Amber	Red Red Red
Required practical activity 4	Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a **filament lamp,** a **diode** and a **resistor** at constant temperature.	Green	Amber	Red

Series and parallel circuits	For series circuits: • The current is the same at all points of the circuit. • The potential difference of the supply = the sum of the potential differences across each component in the loop. • The total resistance R_T = The sum of all the resistances in the loop. $R_T = R_1 + R_2$ etc. Unknowns can be found from: V = IR For parallel circuits • The potential difference across each component is the same as the supply potential difference. • The total current through the whole circuit is the sum of the currents through the separate components. • Resistance decreases with an increase in number of components in parallel due to increased number of pathways for current to flow. • The total resistance of two resistors is less than the resistance of the smallest individual resistor.	Green Green	Amber Amber	Red Red
Mains electricity	Mains supply is a.c with a frequency of 50 Hz. Understand via a CRO trace the difference between an ac and dc potential and explain in terms of direction of polarity - a.c. potential switches polarity periodically - d.c. potential does not switch polarity. Know the colour coding of the three wires: • Brown – live • Blue – neutral • Yellow and green – earth. The live wire (230V on average) carries the alternating potential from the supply. The neutral wire (0V on average) completes the circuit. The earth wire is a safety wire to stop the appliance becoming live. Potential difference (of 230V) is set up when a connection is made between the live and neutral wire. The dangers of touching or making a connection with a live wire and earth. Action of the Earth wire (and fuse) in safety scenarios.	Green	Amber	Red
Energy and Power in circuits	Power transferred by charge in a component in a circuit can be found using the following equations: **P = IxV** **$P=I^2R$** So from the definition of power (Power = Energy transferred/time): Energy transferred = Power x time	Green	Amber	Red

	Energy transferred = I x V x t Also as charge = current x time (Q = I x t) Energy transferred = Potential difference x charge (E = QV) Calculate current/charge/energy transfer in mains devices knowing that V = 230V.			
The National Grid	The structure of the national grid (transformers and pylons). The role of transformers in making transmission more efficient (explain how step up and step-down transformers reduce energy loss in transmission). – to be covered in P7 in detail but can also be examined in paper 1.	Green	Amber	Red
Static Electricity (Physics only)	How rubbing can lead to transferring of ***electrons*** from one surface, leading to the objects becoming (oppositely) charged due to the imbalance of charges – more positive than negative charges or more negative charge than positive ones). Forces between electrostatically charged objects (like charges repel, unlike charges attract). The force is a ***non-contact force.***	Green	Amber	Red
Electric Fields	Charges create an electric field around themselves. A second charged object brought into the field experiences a force that gets stronger as it approaches the object whose field it is in. Use the theory to: • draw the electric field pattern for an **isolated charged sphere** • explain the concept of an electric field • explain how the concept of an electric field helps to explain the non-contact force between charged objects as well as other electrostatic phenomena such as sparking.	Green	Amber	Red