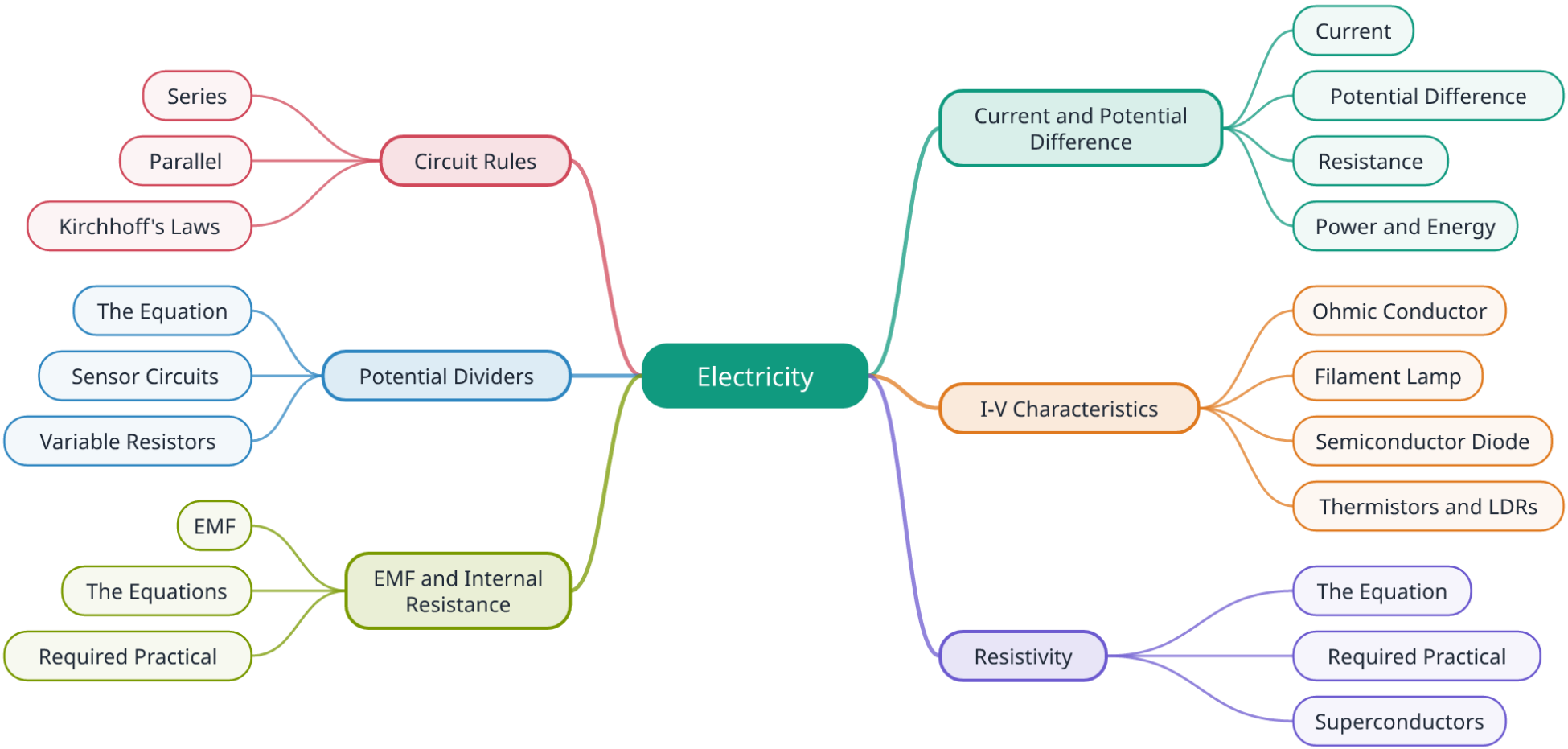
Electricity Mind Map (A Level Physics)

A level · Physics · mindmapi.ai/mind-maps/electricity-a-level-physics



Electricity mind map · mindmapi.ai/mind-maps/electricity-a-level-physics

Electricity mind map explained

Current and Potential Difference

The basic quantities and their definitions.

Current

The rate of flow of charge: I = delta Q / delta t, measured in amperes. In metals the charge carriers are electrons, each carrying 1.6 × 10^-19 C.

Potential Difference

The work done per unit charge: V = W / Q, measured in volts.

Resistance

R = V / I, measured in ohms.

Power and Energy

P = VI = I^2R = V^2/R, and energy transferred E = VIt.

I-V Characteristics

How current varies with potential difference for different components.

Ohmic Conductor

A straight line through the origin: current is directly proportional to potential difference, at constant temperature (Ohm's law).

Filament Lamp

A curve that flattens: as the filament heats up, its resistance increases.

Semiconductor Diode

Conducts in the forward direction once the potential difference passes a threshold, and has a very high resistance in reverse.

Thermistors and LDRs

The resistance of a negative temperature coefficient thermistor falls as temperature rises. The resistance of a light-dependent resistor falls as light intensity rises.

Resistivity

A property of the material, not the shape of the conductor.

The Equation

rho = RA / L, where A is the cross-sectional area and L the length. Measured in ohm metres.

Required Practical

AQA required practical: measure the resistance of a wire at different lengths, and the diameter with a micrometer at several points. The gradient of R against L equals rho / A.

Superconductors

Materials with zero resistivity below their critical temperature. Uses include strong magnets for MRI scanners and power cables with no energy loss.

Circuit Rules

Based on conservation of charge and conservation of energy (Kirchhoff's laws).

Series

The same current flows through every component; the potential differences add up to the supply; R = R1 + R2 + ...

Parallel

Each branch has the same potential difference; the currents add up; 1/R = 1/R1 + 1/R2 + ...

Kirchhoff's Laws

The total current into a junction equals the total out. Around any closed loop, the sum of the EMFs equals the sum of the potential differences.

Potential Dividers

Two resistors in series that split the supply voltage.

The Equation

V_out = V_in × R2 / (R1 + R2). The bigger share of resistance takes the bigger share of the potential difference.

Sensor Circuits

Replacing a resistor with a thermistor or LDR makes the output voltage change with temperature or light, for example to switch on a heater or a street light.

Variable Resistors

A potentiometer gives a continuously variable output voltage.

EMF and Internal Resistance

Real power supplies have resistance of their own.

EMF

The energy transferred to each coulomb of charge by the source: emf = E / Q.

The Equations

emf = I(R + r), so the terminal potential difference V = emf - Ir. The Ir term is the lost volts.

Required Practical

AQA required practical: vary the external resistance and record V and I. On a graph of V against I, the y-intercept is emf and the gradient is -r.

How to revise with this mind map

1. Learn every equation with its units, and practise rearranging them. Most electricity marks come from substitution and rearrangement.

2. Sketch the I-V graphs from memory for each component and explain the shape, especially why the filament lamp's resistance rises.

3. For circuit problems, write down what is shared: current in series, potential difference in parallel. Then apply the rules step by step.

4. Know both required practicals: the method, how to reduce uncertainty, and how to get the answer from the graph's gradient or intercept.

5. Make it yours. Build your own electricity map in Mindmapi from your notes, and ask the AI about anything you are unsure of. The answer is saved into that branch's notes for next time.