

P2 Electricity

Physics Paper 1 | AQA Combined Science Trilogy | Build confidence with the core ideas

Current → A

Voltage → V

Resistance → Ω

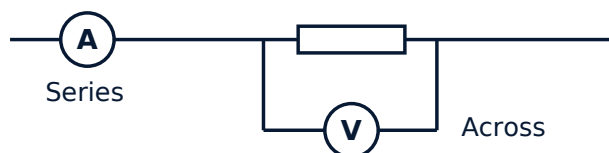
Power → W

1 Current, voltage and resistance

Current: rate of flow of charge.

Voltage (pd): energy transferred per coulomb.

Resistance: opposes current. At the same voltage, more $R \rightarrow$ less I .



$Q = It$ · charge (C), current (A), time (s).

$V = IR$ · volts, amperes, ohms.

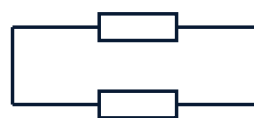
Charge is **not used up** in a component.

2 Series and parallel

Series: one path



Parallel: branches



Series: same current everywhere.

Supply voltage is shared.

$R_{\text{total}} = R_1 + R_2$. One break stops it all.

Parallel: same voltage across branches.

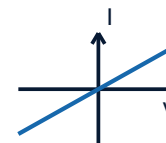
Total current = sum of branch currents.

Total R is less than any single branch R .

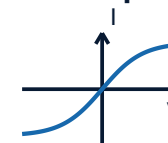
Other complete branches can still work if one branch breaks.

3 Components and I-V graphs

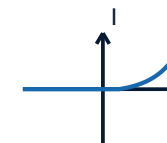
Resistor



Lamp



Diode



Ohmic resistor: constant R at constant temperature; straight line through origin.

Filament lamp: hotter $\rightarrow$ greater R .

Diode: current mainly one way.

LDR: brighter light $\rightarrow$ lower R .

Thermistor: warmer $\rightarrow$ lower R .

LDRs sense light; thermistors sense temperature.

4 Mains and electrical safety

UK mains: AC, about **230 V, 50 Hz**.

AC reverses direction; DC flows one way.

 **Brown: live**

 **Blue: neutral**

 **Green and yellow: earth**

Neutral completes the circuit; near 0 V.

Earth: 0 V; no current normally.

Fault to a metal case $\rightarrow$ earth fault current $\rightarrow$ fuse melts $\rightarrow$ live circuit breaks.

Live parts can remain dangerous with an open switch. Insulation prevents contact.

5 Power, energy and the Grid

Power: energy transferred per second.

1 W = 1 J/s.

$P = VI$ or $P = I^2R$

$E = Pt$ or $E = QV$

Use **W, s, J, C, V, A, Ω** as appropriate.

1 minute = 60 s; 1 kW = 1000 W.

Example: 10 W $\times$ 3 s = 30 J.

National Grid: cables and transformers.

Step-up: voltage increases. For the same power, current decreases $\rightarrow$ less heating loss in cables.

Step-down: reduces voltage for consumers.

6 Required practicals

Use a low-voltage supply.

Measure R : ammeter in series, voltmeter across component. $R = V / I$.

Wire length: measure between contacts. Keep material and thickness the same. Limit heating: low current; switch off between readings.

Combinations: compare one resistor with series and parallel combinations.

I-V: vary voltage/current, record pairs, then reverse supply for reverse readings. Plot I vertically against V horizontally.

Improve: repeat, check unusual readings and calculate suitable means.