

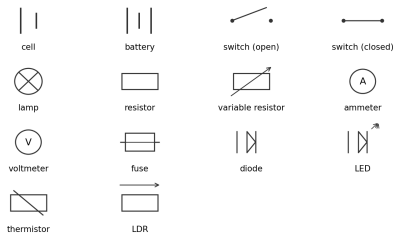
Topic 2: Electricity

AQA GCSE Physics 8463 · spec 4.2 · sheets 2.1–2.8

Electricity runs both papers

- Paper 1 carries Electricity; Paper 2 draws on it too.
- The equations sheet is enclosed; chains link the equations.
- Ammeters in series, voltmeters in parallel.

Fourteen symbols you must draw



Ammeters go in series; voltmeters in parallel across the component

- Cell, battery, switches, lamp, resistor, variable resistor.
- Ammeter, voltmeter, diode, LED, thermistor, LDR, fuse.
- Draw them exactly as the chart shows.

Charge flows only in a closed loop

- Current is a flow of charge; its size is the rate of flow.
- $Q = It$ with time in seconds.
- The current is the same at every point of one loop.

Your turn: charger charge

- A charger delivers 0.90 A for 25 minutes.
- Calculate the charge flow before the answer appears.

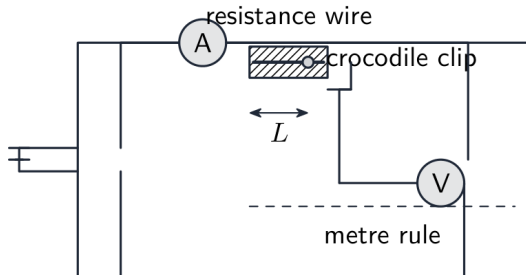
Charger charge worked

- 1 **Convert** $25 \text{ min} = 1500 \text{ s}$ (its own mark).
- 2 **Equation** $Q = It = 0.90 \text{ A} \times 1500 \text{ s}$.
- 3 **Answer** $Q = 1350 \text{ C}$.

The one equation with three forms

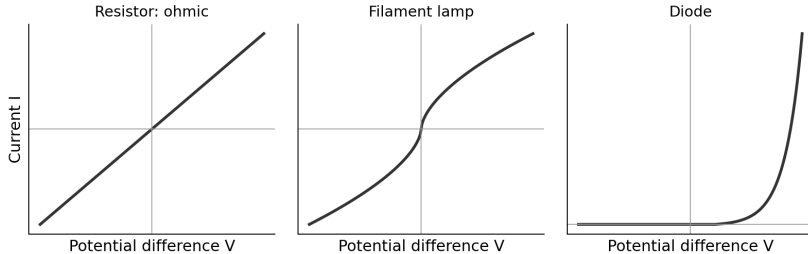
- $V = IR$: choose the rearrangement before substituting.
- Greater resistance means smaller current at the same pd.
- Read R from a graph point with $R = V/I$.

RP3: resistance of a wire



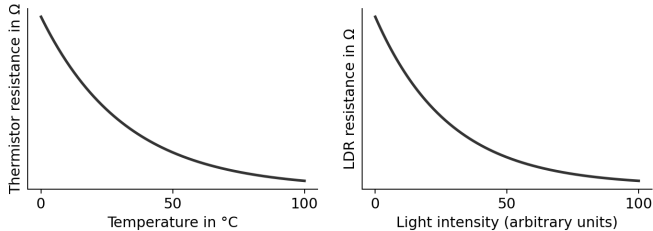
- Wire taped along a metre rule; a clip sets the length.
- Read ammeter and voltmeter; calculate $R = V/I$.
- Resistance is directly proportional to length.

Three shapes name the component



- Resistors and I–V characteristics: three graph shapes.
- Resistor: straight line; lamp: S-curve; diode: one way.
- The shape names the component.

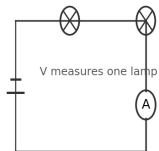
Sensors that fall



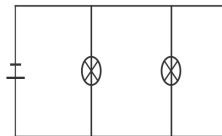
- Thermistor: resistance falls as temperature rises.
- LDR: resistance falls as light intensity rises.
- Applications: thermostat, automatic lighting.

Series shares, parallel repeats

Series: one loop



Parallel: branches



same pd across each lamp; branch currents add

- Series: same current; pd shared; resistances add.
- Parallel: same pd; currents add; total resistance below the smallest.
- Explain both trends with paths for charge.

Your turn: two lamps

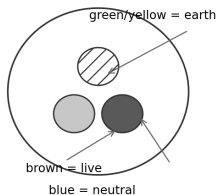
- A 12 V battery drives two $8.0\ \Omega$ lamps.
- Find the current and lamp pd in series, then the total current in parallel.

Two lamps worked

- 1 **Series** $R_{total} = 8.0 + 8.0 = 16 \Omega$; $I = 12/16 = 0.75 \text{ A}$; $V_{lamp} = 6.0 \text{ V}$.
- 2 **Parallel** each lamp 12 V ; $I_{lamp} = 12/8.0 = 1.5 \text{ A}$.
- 3 **Total** $I_{total} = 1.5 + 1.5 = 3.0 \text{ A}$.
- 4 **Why brighter** full supply pd across each lamp, so more power per lamp.

Mains: 230 volts, 50 hertz, alternating

three-core cable (cross-section)



the three wires

live

carries the 230 V ac potential difference

neutral

completes the circuit, near 0 V

earth

safety wire at 0 V for faults

mains: about 230 V, 50 Hz, alternating

- Domestic uses and safety: mains is ac, about 230 V, 50 Hz.
- Live is brown, neutral is blue, earth is green/yellow.
- Earth is the safety wire at 0 V.

Why live is dangerous even switched off

- The switch breaks only the live wire.
- Supply-side wiring stays at about 230 V relative to earth.
- Any live-to-earth path is a large, dangerous current.

Chains of power equations

- $P = VI$ and $P = I^2 R$ for power.
- $E = Pt$ and $E = QV$ for energy.
- Convert minutes to seconds before anything else.

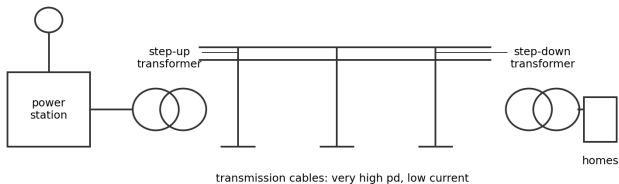
Your turn: lamp energy

- A lamp carries 0.21 A at 6.0 V for 30 minutes.
- Calculate the energy transferred.

Lamp energy worked

- 1 **Convert** $30 \text{ min} = 1800 \text{ s}$.
- 2 **Power** $P = VI = 6.0 \text{ V} \times 0.21 \text{ A} = 1.26 \text{ W}$.
- 3 **Energy** $E = Pt = 1.26 \text{ W} \times 1800 \text{ s} \approx 2300 \text{ J}$.

The Grid trades current for voltage



- Step-up transformer raises pd for the cables.
- Same power at higher pd means lower current.
- Cable waste is $P = I^2 R$ — so losses collapse.

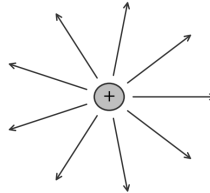
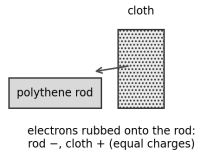
Your turn: cable waste

- A cable carries 2000 A; its resistance is $40\ \Omega$.
- Calculate the wasted power at 2000 A and at 500 A.

Cable waste worked

- 1 **At 2000 A** $P = I^2 R = (2000)^2 \times 40 = 1.6 \times 10^8 \text{ W}$.
- 2 **At 500 A** $P = (500)^2 \times 40 = 1.0 \times 10^7 \text{ W}$.
- 3 **Compare** current $\times \frac{1}{4}$, waste $\times \frac{1}{16}$.

Electrons rub off — physics only



field of an isolated positive sphere: strongest close, weaker far away

- Rubbing transfers electrons between insulators.
- Gaining electrons: negative. Losing them: positive.
- Like charges repel, unlike attract.

The field explains the force

- An electric field surrounds every charge.
- Strongest close, weaker with distance.
- Radial arrows point away from a positive sphere.

Check yourself

- Checklist before you call this topic done.
- Symbols and meters; equations from the wording.
- Series and parallel rules; both practicals from memory.