

Exercise walk-through

2.2

Circuits and resistance

Pearson Edexcel · International GCSE · Physics

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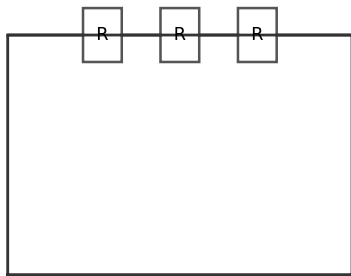
The method

Method — Same current or same voltage

Series: $R = R_1 + R_2$; the current is the same everywhere; voltages add to the supply.

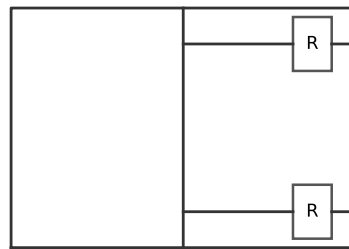
Parallel: each branch gets the full supply voltage; currents add at junctions (charge conserved); combined resistance is less than either resistor.

series: one loop, same current



one loop: same current everywhere; voltages add

parallel: branches, same voltage

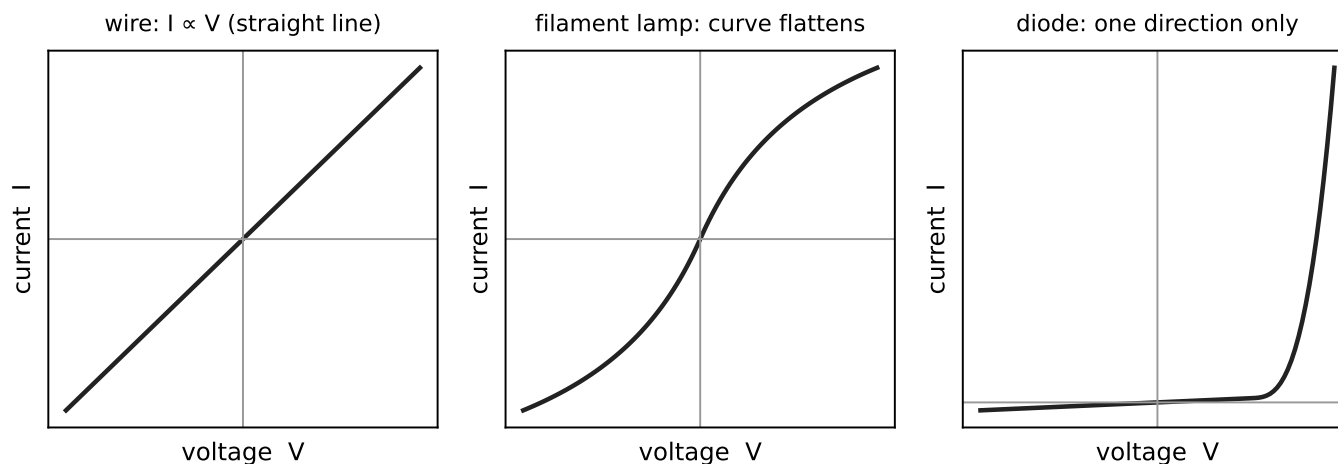


voltage the same on each branch; currents add

Series: one loop, same current. Parallel: branches, same voltage, currents add.

Method — Three curves to know

Wire: straight line (ohmic). Lamp: S-curve – resistance rises as the filament heats.
 Diode: conducts only forwards. LDR resistance falls with light; thermistor resistance falls as temperature rises.



I-V curves for a wire, filament lamp and diode.

Exercises 2.1·2.3

2.1 Give two reasons domestic lighting is wired in parallel. [2]

2.2 State the current rule at a junction. [1]

2.3 A $12\ \Omega$ resistor carries $0.5\ \text{A}$. Calculate the voltage across it. [2]

Exercises 2.1·2.3

2.1 Give two reasons domestic lighting is wired in parallel. [2]

2.1 Each lamp gets the full supply voltage; lamps work independently – one failing does not stop the others.

2.2 State the current rule at a junction. [1]

2.2 Total current in equals total current out – charge is conserved.

2.3 A $12\ \Omega$ resistor carries $0.5\ \text{A}$. Calculate the voltage across it. [2]

2.3 $V = 0.5 \times 12 = 6\ \text{V}$.

Exercises 2.4·3.1

2.4 Calculate the combined resistance of $4\ \Omega$ and $6\ \Omega$ in series, and state the current when $10\ \text{V}$ is applied. [3]

2.5 State what happens to a thermistor's resistance when it is cooled. [1]

3.1 A $4\ \Omega$ and a $6\ \Omega$ resistor are in series across a $10\ \text{V}$ supply. Calculate the circuit current and the voltage across each resistor. [4]

Exercises 2.4·3.1

2.4 Calculate the combined resistance of $4\ \Omega$ and $6\ \Omega$ in series, and state the current when $10\ \text{V}$ is applied. [3]

2.4 $R = 4 + 6 = 10\ \Omega$; $I = 10/10 = 1\ \text{A}$.

2.5 State what happens to a thermistor's resistance when it is cooled. [1]

2.5 It rises.

3.1 A $4\ \Omega$ and a $6\ \Omega$ resistor are in series across a $10\ \text{V}$ supply. Calculate the circuit current and the voltage across each resistor. [4]

3.1 Total $R = 10\ \Omega$; $I = 10/10 = 1\ \text{A}$; $V_1 = 1 \times 4 = 4\ \text{V}$; $V_2 = 1 \times 6 = 6\ \text{V}$ – the voltages add to the supply.

Exercises 3.2·3.3

3.2 Describe how the resistance of a filament lamp changes as the voltage rises, and explain why. [3]

3.3 A charge of 45 C flows through a lamp in 30 s. Calculate the current and, if the lamp is 6 V, the energy transferred. [4]

Exercises 3.2-3.3

3.2 Describe how the resistance of a filament lamp changes as the voltage rises, and explain why. [3]

3.2 The resistance increases as voltage (and current) rises: the larger current heats the filament to a higher temperature; the ions in the metal vibrate more, so electrons collide with them more often and the lattice resists the flow more.

3.3 A charge of 45 C flows through a lamp in 30 s. Calculate the current and, if the lamp is 6 V, the energy transferred. [4]

3.3 $I = Q/t = 45/30 = 1.5 \text{ A}$; $E = QV = 45 \times 6 = 270 \text{ J}$.