Exercise walk-through

Electric circuits ▪ 4.3

eXercise

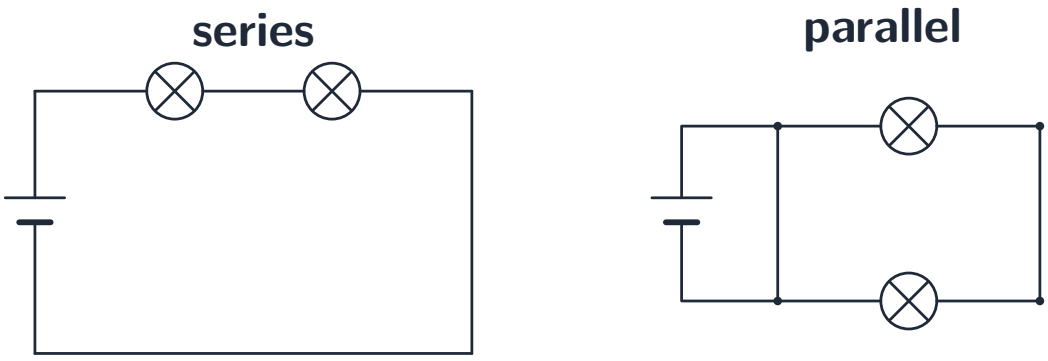
You must be able to

- use the current/p.d. rules for series and parallel circuits
- add series resistors and combine two parallel resistors
- use the potential-divider idea ($\frac{R_1}{R_2} = \frac{V_1}{V_2}$)

Method — Combining resistors

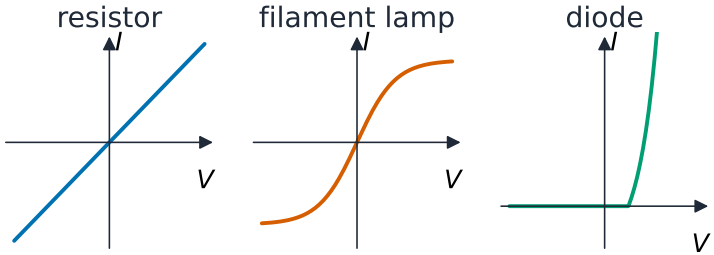
$6\ \Omega$ **and** $3\ \Omega$ **in parallel:** $\frac{1}{R} = \frac{1}{6} + \frac{1}{3} = \frac{1}{2} \Rightarrow R = 2\ \Omega.$

Method — Combining resistors



A series circuit (one loop) beside a parallel circuit (separate branches)

Method — Combining resistors



resistor (ohmic): $V = IR$ straight · filament: resistance rises with heat · diode: one-way

I–V graphs: straight line (resistor), S-curve (lamp), one-way (diode)

Practice 2.1 ▪ 1 mark

Two resistors of $4\ \Omega$ and $6\ \Omega$ are in series. Find the total resistance.

Solution 2.1

Method: Combining resistors

Worked steps

$R = 4 + 6 = 10\ \Omega$ **B1**.

Practice 2.2 ▪ 1 mark

State how the current behaves at every point in a series circuit.

Solution 2.2

Method: Combining resistors

Worked steps

the current is the same at every point B1.

Exam-style 3.1 ▪ 1 mark

Compared with the smallest single resistor, two resistors in parallel give a total resistance that is:

A larger

B smaller

C the same

D zero

Solution 3.1

Method: Combining resistors

A larger

B smaller ✓

C the same

D zero

Worked steps

B. Two resistors in parallel give a total smaller than the smaller one.

Exam-style 3.2 ▪ 3 marks

A 12 V supply is connected to a $4\ \Omega$ and an $8\ \Omega$ resistor in series.
(a) Find the total resistance and the current.
(b) Find the p.d. across the $8\ \Omega$ resistor.

Solution 3.2

Method: Combining resistors

Worked steps

(a) $R = 4 + 8 = 12\ \Omega$ M1; $I = \dfrac{V}{R} = \dfrac{12}{12} = 1.0$ A M1 A1.

(b) $V = IR = 1.0 \times 8 = 8.0$ V M1 A1.

Exam-style 3.3 ▪ 4 marks

A $6\ \Omega$ and a $12\ \Omega$ resistor are connected in parallel across a 6 V supply. Find the total resistance and the total current from the supply.

Solution 3.3

Method: Combining resistors

Worked steps

$\frac{1}{R} = \frac{1}{6} + \frac{1}{12} = \frac{3}{12} = \frac{1}{4} \Rightarrow R = 4\ \Omega$ M1 M1; $I = \frac{V}{R} = \frac{6}{4} = 1.5$ A M1 A1.