

4.3 Electric circuits

Name: _____ Class: _____ Date: _____

Total: 12 marks

KEY WORDS series and parallel

• parallel • series

• electric circuits

• potential divider

Objective

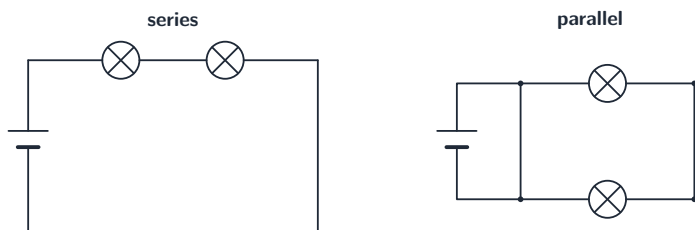
Build the skills to answer exam questions on **electric circuits** – **series and parallel** rules, combining resistors, and **potential dividers**.

You must be able to:

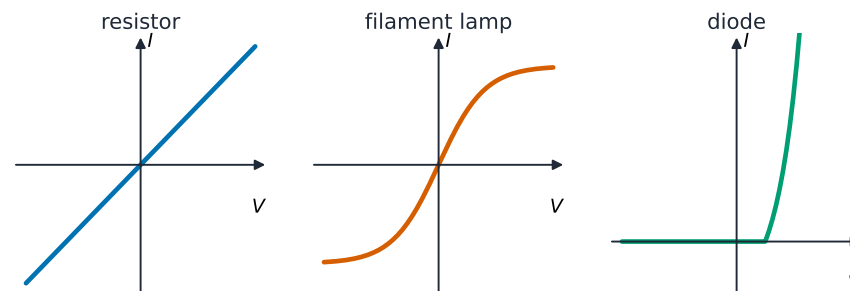
- use the current/p.d. rules for series and parallel circuits
- add series resistors and combine two parallel resistors
- use the potential-divider idea ($\frac{R_1}{R_2} = \frac{V_1}{V_2}$)

1 Key knowledge and worked examples

■ Combining resistors



Series: same current, shared p.d., $R_{total} = R_1 + R_2$. Parallel: same p.d., split current, smaller total R



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

A resistor gives a straight I - V line; a filament lamp curves as it heats

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

2 Practice

2.1 Two resistors of 4 Ω and 6 Ω are in series. Find the total resistance. [1]

2.2 State how the current behaves at every point in a series circuit. [1]

3 Exam-style questions

3.1 Compared with the smallest single resistor, two resistors in parallel give a total resistance that is: [1]

- ☐ **A** larger
☐ **B** smaller
☐ **C** the same
☐ **D** zero

3.2 A 12 V supply is connected to a 4 Ω and an 8 Ω resistor in series.

(a) Find the total resistance and the current. [3]

(b) Find the p.d. across the 8 Ω resistor. [2]

3.3 A 6 Ω and a 12 Ω resistor are connected in parallel across a 6 V supply. Find the total resistance and the total current from the supply. [4]

Solutions

Each answer shows the steps, then the **result**.

2.1

- series: $R = 4\ \Omega + 6\ \Omega = \mathbf{10\ \Omega}$

2.2

- the current is the same at every point

3.1 B

- two resistors in parallel give a total smaller than the smaller one

3.2

(a) series: $R = 4\ \Omega + 8\ \Omega = 12\ \Omega$

- $I = V/R$

$$I = \frac{12\ \text{V}}{12\ \Omega} = \mathbf{1.0\ \text{A}}$$

(b) $V = IR$

$$V = (1.0\ \text{A})(8\ \Omega) = \mathbf{8.0\ \text{V}}$$

3.3

- parallel: $1/R = 1/R_1 + 1/R_2$

$$\frac{1}{R} = \frac{1}{6\ \Omega} + \frac{1}{12\ \Omega} = \frac{1}{4\ \Omega} \Rightarrow R = 4\ \Omega$$

- $I = V/R$

$$I = \frac{6\ \text{V}}{4\ \Omega} = \mathbf{1.5\ \text{A}}$$