

2.2 Circuits and resistance

Name: _____ Class: _____ Date: _____

Total: 20 marks

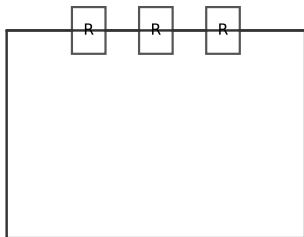
Objective

Cover energy and voltage in circuits (2.7–2.21): series vs parallel, I–V characteristics, LDRs and thermistors, $V = IR$, $Q = It$, $E = QV$ and series resistance calculations. Original IGCSE-level practice.

1 Key knowledge and worked examples

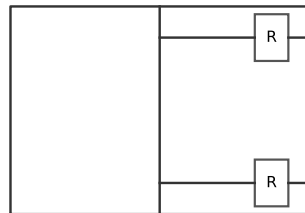
■ Same current or same voltage

series: one loop, same current



one loop: same current everywhere; voltages add

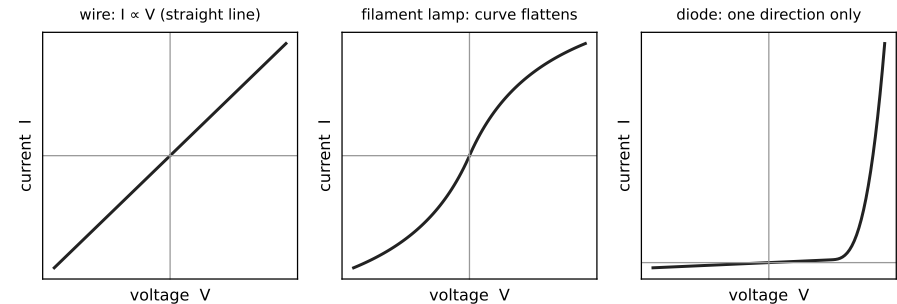
parallel: branches, same voltage



voltage the same on each branch; currents add

Series: $R = R_1 + R_2$; 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.

■ 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.

2 Practice

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 A. Calculate the voltage across it. [2]

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

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

3 Exam-style questions

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]

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

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

Solutions

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

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

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

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

2.5 It rises.

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

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