

Exercise walk-through

Resistance, Resistivity, and Ohm's Law ■ 11.3

eXercise

You must be able to

- apply **Ohm's law** 欧姆定律 $V = IR$ to a resistor
- relate **resistance** 电阻 to the **resistivity** 电阻率, length, and area, $R = \frac{\rho \ell}{A}$
- distinguish **ohmic** from non-ohmic devices using their current-voltage graphs

Method — Ohm's law

$V = IR$ links the potential difference, current, and resistance.

Method — Resistivity

$R = \frac{\rho \ell}{A}$: a **longer** or **thinner** wire has more resistance.

Method — Ohmic vs non-ohmic

An **ohmic** conductor has a straight-line I - V graph through the origin (constant R). A filament lamp is **non-ohmic** — its graph curves because R rises with temperature.

Practice 2.1 ■ 2 marks

A 6.0 V supply drives 2.0 A through a resistor. Find its resistance.

Solution 2.1

Worked steps

$$R = \frac{V}{I} = \frac{6.0}{2.0} = 3.0 \, \Omega \quad \text{M1} \quad \text{A1}.$$

Practice 2.2 ■ 1 mark

State how the resistance of a wire changes if it is made longer.

Solution 2.2

Method: Resistivity

Worked steps

it increases (resistance is proportional to length) **B1**.

Practice 2.3 ■ 1 mark

Describe the current-voltage graph of an ohmic conductor.

Solution 2.3

Method: Ohmic vs non-ohmic

Worked steps

a straight line through the origin (constant resistance) **B1**.

Exam-style 3.1 ■ 1 mark

Ohm's law is

A $V = IR$

B $P = IV$

C $R = \rho \ell / A$

D $Q = It$

Solution 3.1

A $V = IR$



B $P = IV$

C $R = \rho \ell / A$

D $Q = It$

Worked steps

A.

Exam-style 3.2 ■ 1 mark

The resistance of a wire increases if it is made

A shorter

B thicker

C longer

D cooler

Solution 3.2

Method: Resistivity

A shorter

B thicker

C longer



D cooler

Worked steps

C.

Exam-style 3.3 ■ 2 marks

A resistor obeys Ohm's law. A voltage of 9.0 V produces a current of 0.30 A .

- (a) Find its resistance.
- (b) Find the current when the voltage is raised to 15 V .

Solution 3.3

Method: Ohm's law

Worked steps

$$(a) R = \frac{9.0}{0.30} = 30 \, \Omega \quad \text{M1 A1}. \quad (b) I = \frac{V}{R} = \frac{15}{30} = 0.50 \, \text{A} \quad \text{M1 A1}.$$