

Exercise walk-through

Electric Power ■ 11.4

eXercise

You must be able to

- define **electric power** 电功率 as $P = IV$
- express the power in a resistor as $P = I^2 R = \frac{V^2}{R}$
- describe **Joule heating** 焦耳热 (electrical energy to thermal energy)
- find the total energy delivered, $E = Pt$

Method — Power

$P = IV$, in watts. For a resistor, using $V = IR$:

$$P = I^2 R = \frac{V^2}{R}.$$

Method — Joule heating

A resistor turns electrical energy into **thermal energy** at rate $I^2 R$.

Method — Energy

$E = Pt$ over a time interval.

Practice 2.1 ■ 2 marks

A device draws 2.5 A at 12 V. Find the power.

Solution 2.1

Worked steps

$$P = IV = 2.5 \times 12 = 30 \text{ W} \quad \text{M1} \quad \text{A1}.$$

Practice 2.2 ■ 2 marks

A $10\ \Omega$ resistor carries 3.0 A. Find the power dissipated.

Solution 2.2

Method: Power

Worked steps

$$P = I^2 R = (3.0)^2 \times 10 = 90 \text{ W} \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 2 marks

A 100 W device runs for 5.0 minutes. Find the energy it uses.

Solution 2.3

Worked steps

$$E = Pt = 100 \times (5.0 \times 60) = 3.0 \times 10^4 \text{ J} \quad \text{M1} \quad \text{A1}.$$

Exam-style 3.1 ■ 1 mark

The power dissipated in a resistor is

A $I^2 R$

B IR^2

C I/R

D I^2/R

Solution 3.1

Method: Power

A $I^2 R$



B IR^2

C I/R

D I^2/R

Worked steps

A.

Exam-style 3.2 ■ 1 mark

Joule heating converts electrical energy into

- A** light
- B** thermal energy
- C** sound
- D** chemical energy

Solution 3.2

Method: Joule heating

A light

B thermal energy



C sound

D chemical energy

Worked steps

B.

Exam-style 3.3 ■ 2 marks

A resistor dissipates 48 W while carrying 4.0 A.

- (a) Find its resistance.
- (b) Find the voltage across it.

Solution 3.3

Worked steps

$$(a) R = \frac{P}{I^2} = \frac{48}{16} = 3.0 \, \Omega \quad \text{M1} \quad \text{A1}. \quad (b) V = IR = 4.0 \times 3.0 = 12 \, \text{V} \quad \text{B1}.$$