

11.4 Electric Power

Name: _____ Class: _____ Date: _____

Total: 11 marks

Objective

Build the skills to answer exam questions on **electric power**.

You must be able to:

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

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Power

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

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

■ Joule heating

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

■ Energy

$E = Pt$ over a time interval.

2 Practice

2.1 A device draws 2.5 A at 12 V. Find the power. [2]

2.2 A $10\ \Omega$ resistor carries 3.0 A. Find the power dissipated. [2]

2.3 A 100 W device runs for 5.0 minutes. Find the energy it uses. [2]

3 Exam-style questions

3.1 The power dissipated in a resistor is [1]

- **A** I^2R
 - **B** IR^2
 - **C** I/R
 - **D** I^2/R
-

3.2 Joule heating converts electrical energy into [1]

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

3.3 A resistor dissipates 48 W while carrying 4.0 A.

(a) Find its resistance. [2]

(b) Find the voltage across it. [1]

4 Go further

- work through the **11.4 Electric Power** lesson on the **Learn** page;
- read the **Electric Circuits** section of the AP Physics C: E&M handout on the **Know** page.

Solutions

2.1 $P = IV = 2.5 \times 12 = 30 \text{ W}$.

2.2 $P = I^2R = (3.0)^2 \times 10 = 90 \text{ W}$.

2.3 $E = Pt = 100 \times (5.0 \times 60) = 3.0 \times 10^4 \text{ J}$.

3.1 A.

3.2 B.

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