

11.4 Electric Power

Name: _____ Class: _____ Date: _____

Total: 16 marks

KEY WORDS electric power • resistance

Objective

Build the skills to answer exam questions on **electric power**.**You must be able to:**

- calculate **electric power** delivered to a device, $P = IV$
- rewrite power for a resistor as $P = I^2R = \frac{V^2}{R}$
- relate power to the **energy** transferred over time, $E = Pt$

1 Key knowledge and 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 $V = IR$ gives two more forms:

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

■ Energy

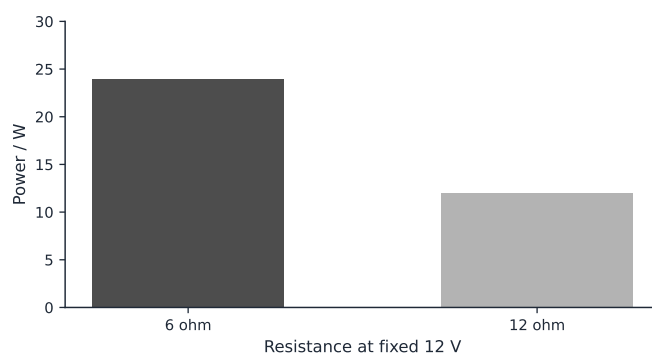
 $E = Pt$ – power multiplied by time.

■ Example

A device drawing 2.0 A at 12 V: $P = 24$ W.

■ Worked application: Choose the power equation from what is held fixed

A $6.0\ \Omega$ resistor is connected across a constant 12 V supply. First $I = V/R = 2.0$ A. Then $P = IV = 24$ W, agreeing with $V^2/R = 24$ W. Over 120 s, $E = Pt = 2880$ J. If the resistor is replaced by $12\ \Omega$ at the same voltage, power falls to 12 W. The expression I^2R does not mean power always rises with resistance: here current also changes. State the fixed quantity before predicting a change.



2 Practice

2.1 A device draws 3.0 A at 12 V. Find the power. [2]

2.2 A $6.0\ \Omega$ resistor carries 2.0 A. Find the power dissipated. [2]

2.3 A 60 W bulb runs for 120 s. Find the energy transferred. [2]

3 Exam-style questions

3.1 Electric power is [1]

- ☐ **A** IV
B I/V
C V/I
D IR

3.2 The power dissipated in a resistor can be written as [1]

- ☐ **A** V^2R
B V^2/R
C I/R^2
D IR^2

3.3 A 240 V heater has a resistance of $60\ \Omega$.

(a) Find the current it draws. [2]

(b) Find the power it dissipates. [2]

3.4 A $9.0\ \Omega$ resistor has 18 V across it for 60 s. (a) Calculate the current and power. [2]

(b) Calculate the transferred energy and predict the power if resistance doubles at the same voltage. [2]

Solutions

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

2.1

- $P = IV = 3.0 \times 12 = 36 \text{ W}$

2.2

- $P = I^2 R = (2.0)^2 \times 6.0 = 24 \text{ W}$

2.3

- $E = Pt = 60 \times 120 = 7200 \text{ J}$

3.1 A

- IV .

3.2 B

- V^2/R .

3.3

(a)

- $I = \frac{V}{R} = \frac{240}{60} = 4.0 \text{ A}$

(b)

- $P = IV = 4.0 \times 240 = 960 \text{ W}$

3.4

(a) $I = V/R = 18/9 = 2.0 \text{ A}$; $P = IV = 36 \text{ W}$.

(b) $E = Pt = 36 \times 60 = 2160 \text{ J}$; $P = V^2/R$ gives 18 W when $R = 18 \Omega$.