

Exercise walk-through

11.4

Electric Power

AP Physics 2

You must be able to

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

1

The method

Method — Power

$P = IV$, in watts. For a resistor, using $V = IR$ gives two more forms:

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

Exercises 2.1-2.2

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]

Exercises 2.1-2.2

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

[2]

2.1

$$P = IV = (3.0 \text{ A})(12 \text{ V})$$

- $P = \mathbf{36 \text{ W}}$

2.2 A $6.0 \, \Omega$ resistor carries 2.0 A. Find the power dissipated.

[2]

2.2

$$P = I^2 R = (2.0 \text{ A})^2 (6.0 \, \Omega)$$

- $P = \mathbf{24 \text{ W}}$

Exercises 2.3-3.1

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

[2]

3.1 Electric power is

[1]

☐

A IV

B I/V

C V/I

D IR

Exercises 2.3-3.1

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

[2]

2.3

$$E = Pt = (60 \text{ W})(120 \text{ s})$$

- $E = 7200 \text{ J}$

3.1 Electric power is

[1]

☐

A IV

B I/V

C V/I

D IR

3.1 A

- IV .

Exercise 3.2

3.2 The power dissipated in a resistor can be written as

[1]

☐

A $V^2 R$

B V^2/R

C I/R^2

D IR^2

Exercise 3.2

3.2 The power dissipated in a resistor can be written as

[1]

☐

A $V^2 R$

B V^2/R

C I/R^2

D IR^2

3.2 B

- V^2/R .

Exercise 3.3 (a)

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

(a) Find the current it draws.

[2]

Exercise 3.3 (a)

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

(a) Find the current it draws.

[2]

(a)

$$I = \frac{V}{R} = \frac{240\ \text{V}}{60\ \Omega}$$

- $I = 4.0\ \text{A}$

Exercise 3.3 (b)

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

(b) Find the power it dissipates.

[2]



Exercise 3.3 (b)

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

(b) Find the power it dissipates.

[2]



(b)

$$P = IV = (4.0\ \text{A})(240\ \text{V})$$

- $P = \mathbf{960\ \text{W}}$

Exercise 3.4 (a)

3.4 A $9.0\ \Omega$ resistor has $18\ \text{V}$ across it for $60\ \text{s}$.

(a) Calculate the current and power.

[2]

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3.4 A $9.0\ \Omega$ resistor has $18\ \text{V}$ across it for $60\ \text{s}$.

(a) Calculate the current and power.

[2]

(a)

$$I = \frac{V}{R} = \frac{18\ \text{V}}{9.0\ \Omega} = \mathbf{2.0\ A}$$

$$P = IV = (2.0\ \text{A})(18\ \text{V}) = \mathbf{36\ W}$$

Exercise 3.4 (b)

3.4 A $9.0\ \Omega$ resistor has $18\ \text{V}$ across it for $60\ \text{s}$.

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

Exercise 3.4 (b)

3.4 A $9.0\ \Omega$ resistor has 18 V across it for 60 s .

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

(b)

$$E = Pt = (36\text{ W})(60\text{ s}) = \mathbf{2160\text{ J}}$$

- at fixed V , $P = \frac{V^2}{R}$, so doubling R halves P : $P = \frac{(18\text{ V})^2}{18\ \Omega} = \mathbf{18\text{ W}}$