PQ 11

Questions and Answers

Q1

A 110-volt toaster oven draws a current of 6 amps on its highest setting as it converts electrical energy into thermal energy. What is the toaster's maximum power rating?

$$P = VI = (110V)(6A) = 660W$$

Q2

An electric iron operating at 120 volts draws 10 amperes of current. How much heat energy is delivered by the iron in 30 seconds?

$$W = Pt = VIt = (120V)(10A)(30s) = 3.6\times10^{4}\,J$$

Q3

One watt is equivalent to one

J/s, since Power is W/t, and the unit of work is the joule, and the unit of time is the second.

Q4

A potential drop of 50 volts is measured across a 250-ohm resistor. What is the power developed in the resistor?

$$P = \frac{V^2}{R} = \frac{(50V)^2}{250\Omega} = 10W$$

Q5

A driving lamp fitted to a car is specified as a 100 W, 12.0 V lamp. Calculate

(a) the current flowing through the lamp, and

(b) the resistance of the lamp.

(a) $P = VI$

$100 = 12.0\,I$

$\therefore I = 8.33\,A$

(b) $V = IR$

$12.0 = 8.33\,R$

$\therefore R = 1.44\,\Omega$

Q6

An electric motor found in a child's toy requires two 1.50 V dry cell batteries to be connected in series. If the motor draws a maximum current of 300 mA calculate

(a) the resistance of the motor, and

(b) the maximum power consumption of the toy.

(a) $V = IR$

$3.00 = 0.300\,R$

$\therefore R = 10.0\,\Omega$

(b) $P = VI$

$= 3.00 \times 0.300$

$\therefore P = 0.900\,W$

Q7

A Christmas tree is decorated by a string of 16 light globes which are connected in series to a mains outlet of 240 V. If the total power consumption is 24.0 W, calculate the

(a) potential difference across each light globe, and

(b) resistance of each light globe.

(a) *Potential difference across each globe*

$$= \frac{240}{16} = 15\ V$$

(b) $Power = \frac{V^2}{R}$

$$R = \frac{(240)^2}{24} = 2.40 \times 10^3\ \Omega$$

$$Resistance\ of\ circuit = 2.40 \times 10^3\ \Omega$$

$$\therefore\ Resistance\ of\ each\ globe = \frac{2.40 \times 10^3}{16}$$

$$= 150\ \Omega$$

Q8

Charles wishes to connect a number of 75.0 W, 240 V coloured party light globes around his patio. How many globes can he use without blowing a 10.0 A fuse when he turns the light globes on?

Maximum power output $= VI$

$= 240 \times 10$

$= 2400\ W$

$\therefore$ *Number of 75 W light globes which would blow the fuse* $= \frac{2400}{75}$

$= 32$

$\therefore$ *Maximum number of light globes to be used*

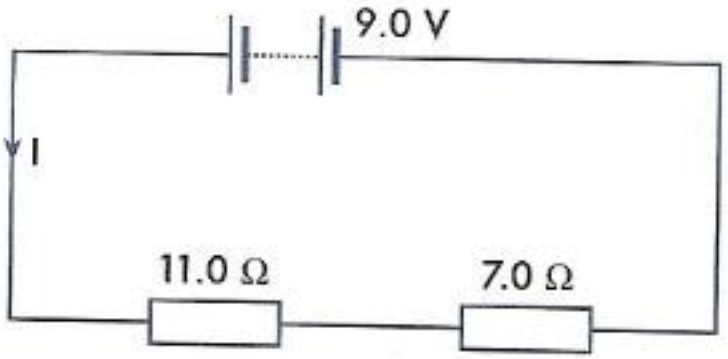
$= 31$

Q9

For the circuit drawn below calculate the

(a) total resistance of the circuit, and

(b) the current, I.



(a) $R_T = R_1 + R_2$

$= 11 + 7$

$= 18\ \Omega$

$\therefore$ *Resistance of circuit* $= 18\ \Omega$

(b) $V = IR$

$9.0 = I \times 18$

$\therefore I = 0.50\ A$

$\therefore$ *Current through circuit* $= 0.50\ A$

Q10

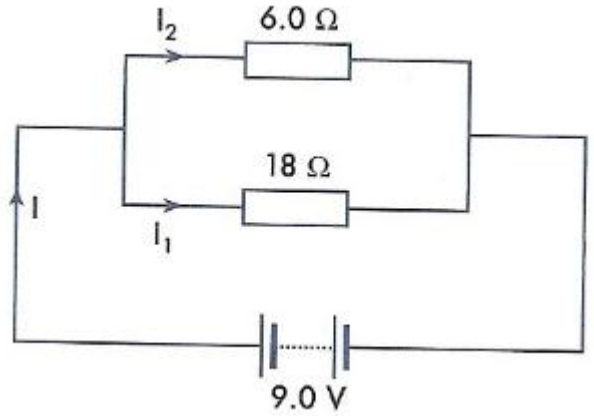
For the circuit drawn below calculate the

(a) total resistance of the circuit,

(b) I,

(c) I_1, and

(d) the potential difference across the 6.0 Ω resistor.



(a) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$

$= \frac{1}{18} + \frac{1}{6}$

$= \frac{1+3}{18}$

$= \frac{4}{18}$

$\therefore R_T = 4.5\ \Omega$

$\therefore$ *Resistance of circuit* $= 4.5\ A$

(b) $V = IR$

$9.0 = I \times 4.5$

$\therefore I = 2.0\ A$

(c) $I_1 = \frac{9.0}{1.8}$

$= 0.5\ A$

(d) $I = I_1 + I_2$

$2.0 = 0.5 + I_2$

$\therefore I_2 = 1.5\ A$

$\therefore PD = IR$

$= 1.5 \times 6.0$

$= 9.0\ V$