DC Electricity

Definitions

An electric current is a movement of charge. In conductors, the electrons that carry the negative charges are free to move. The current in an electric circuit is caused by the movement of the charges through the circuit.

Electrical potential is often referred to as voltage where
1 volt = 1 joule /1 coulomb (a measure of how much energy each electron carries)

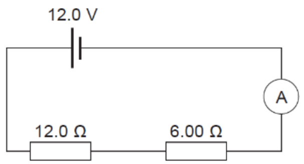
Equations

$I = \frac{q}{t}$	Current	I	A
	Charge	q	C
	Time	t	s
$V = \frac{\Delta E}{q}$	Voltage	V	V
	Change in Energy	ΔE	J
	Charge	q	C
$V = IR$	Voltage	V	V
	Current	I	A
	Resistance	R	Ω
$P = IV$	Power	P	W (J s^{-1})
	Current	I	A
	Voltage	V	V
$P = \frac{\Delta E}{t}$	Power	P	W (J s^{-1})
	Change in Energy	ΔE	J
	Time	t	s

Questions

CIRCUITS (2021;1)

Bob is investigating circuits in the laboratory and starts with the circuit shown. The voltage across the 12.0 Ω resistor is 8.00 V.



(a) Calculate the current in the circuit.

(b) Calculate the amount of energy converted to heat in one hour in the 6.00 Ω resistor.

Claire's car lights (2011;3)

Claire has a light bulb inside her car. The light bulb is labelled "12 V 5 W", and it is connected to the car's 12 V battery.

(c) Describe what the label means.

(d) Calculate the size of the current in the light bulb when it is switched on.

Terms

Current Electricity: The continuous flow of electrons through a conductor.
Electron current: Opposite to conventional current; consists of a drift of negative charges that flows from the negative terminal to the positive terminal of a battery.

Tips

- By convention – conventional current flows from positive to negative even though this is NOT the direction of the electrons.
- The power consumed by a light bulb (which determines how **bright** it is and how much energy it converts to heat/light per second) depends on **both** the **current** going through it and the **voltage** across it
- P = VI and V = IR can be combined to make $P = I^2R$ or $P = V^2/R$

Answers

(a) $I = \frac{V}{R} = \frac{8}{12} = 0.667 \text{ A}$

(b) $P = IV = 0.667 \times 4 = 2.67 \text{ W}$

OR $P = I^2R = 0.667^2 \times 6 = 2.67 \text{ W}$

$E = Pt = 2.67 \times 60 \times 60 = 9604 = 9600 \text{ J}$

(c) When the bulb has 12 V across it, the power output is 5 W.

(d)

$P = VI$

$I = \frac{P}{V}$

$I = \frac{5}{12} = 0.42 \text{ A}$