PhyzExamples: Electric Current & Circuits

Physical Quantities • Symbols • Units • Brief Definitions

Charge • *q or Q* • coulomb [*KOO lom*]: C • A characteristic of certain fundamental particles.
Current • *I* • coulomb per second: C/s or ampere: A • The rate at which electric charge flows.
Voltage • *V* or $\mathcal{E}$ • joule per coulomb: J/C or volt: V • Electric potential energy per unit of charge; electric "oomph."
Resistance • *R* • volt per amp: V/A or ohm: Ω • A measure of the obstruction to flow of electric charge that a *body* possesses.
Power • *P* • watt: W • The rate at which energy is transferred in an electric circuit.

Equations

$I = q/t$ • *current = charge / time*
$I = V/R$ or $\mathcal{E}/R$ • Ohm's Law • *current = voltage / resistance*
$P = IV$ or $I\mathcal{E}$ • Joule's Law • *power = current · voltage*
$P = I^2R$ • *power = square of current · resistance*
$P = V^2/R$ *or* $\mathcal{E}^2/R$ • *power = square of voltage / resistance*

Smooth Operations Examples

1. What is the current in a wire if 15.7 C of charge move past a point in the wire every 2.3 s?

1. q = 15.7 C   t = 2.3 s   I = ?
I = q/t
I = 15.7 C / 2.3 s
<u>I = 6.8 A</u>

2. A current of 0.82 A passes through a 47-Ω resistor. What is the potential difference across the resistor?
(The question is asking for the voltage.)

2. I = 0.82 A   R = 47 Ω   V = ?
I = V/R
V = IR
V = 0.82 A · 47 Ω
<u>V = 39 V</u>

3. If a 100-W stereo system is plugged into the 120-V line voltage used in US homes, how much current does it draw?

3. P = 100 W   V = 120 V   I = ?
P = IV
I = P/V
I = 100 W / 120 V
<u>I = 0.83 A</u>

4. What is the resistance of a 1500-W hair dryer that draws 13 A of current?

4. P = 1500 W   I = 13 A   R = ?
$P = I^2R$
$R = P/I^2$
$R = 1500\ W / (13\ A)^2$
<u>R = 8.9 Ω</u>

5. An appliance with a resistance of 36 Ω operates at 9.0 V. At what rate does it dissipate energy? (That is, what's the power?)

5. R = 36 Ω   V = 9.0 V   P = ?
$P = V^2/R$
$P = (9.0\ V)^2 / 36\ \Omega$
<u>P = 2.3 W</u>

6. How much voltage must be applied to an 8-Ω resistor to produce 27 W of power?

6. P = 27 W   R = 8 V   V = ?
$P = V^2/R$
$V = \sqrt{PR}$
$V = \sqrt{(27\ W \cdot 8\ \Omega)}$
<u>V = 15 V</u>

Equations from combining Ohm's Law and Joule's Law

Complete all the petals of the flower by rearranging $I = V/R$, $P = IV$, $P = I^2R$, and $P = V^2/R$.