Ohm's Law

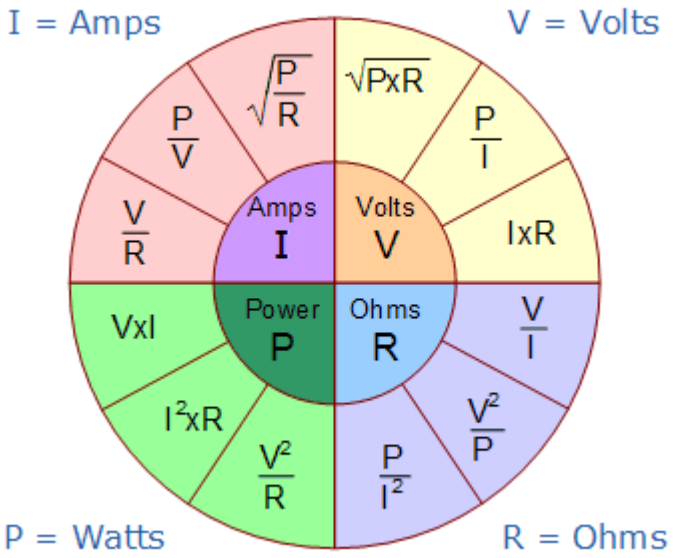
It's just 9 new eq^{n}. How hard can it be?

1st let's review some Jr. Science (grade 9):

Electric Current: Cras...

More review (if you need it):

Electric Circuits: Basi...



Ohm's Law:

$$V = IR$$

V = Volts, I = Current, R = Resistance

Current: This is the number of charged particles flowing through a circuit per second

The charge of a particle is measured in Coulombs (a single electron / proton / positron / antiproton has a charge of: 1.6×10^{-19} C.

One Coulomb is extremely tiny!

Q = It where:

$Q = It$

Q is total charge of particles
I is current (in Amperes, A)

t is time (in seconds)

Eg: If 4 amps of current flows for 5 seconds, how many electrons flow?

$Q = 4(5)$

$Q = 20$

$20 \cdot \frac{1 \text{ e}^-}{1.6 \times 10^{-19} \text{ C}} =$

1.25×10^{20} electrons.

Voltage: This is the change in electric potential per charge

As electrons flow through the circuit they gain potential energy as they flow through a battery and lose potential energy as they flow through devices in the circuit.

This is the driving force behind current flow.

Resistance: This is a measure of the opposition to current flow in a circuit

It is measured in the units of Ohms Ω This is the Greek letter 'Omega'.

We control the resistance of a circuit by adding / subtracting devices or pathways.

Enough definitions.
"Let's get this party started"
--J. Bieber, 2009

A lightbulb has a resistance of 20 Ω. If 0.6 A is flowing through it, what is the voltage drop across the light bulb?

Hint: 12 V

$R = 20\ \Omega$

$I = .6\ A$

$V = ?$

$V = \frac{3(\cancel{20}^{4})}{\cancel{5}} = 12\ V$

3 A flows through a lightbulb with a voltage drop of 6 V, what is the resistance?

Hint: 2 Ω

$I = 3$, $V = 6$, $R = ?$

$V = IR$

$6 = 3R$

$\frac{6}{3} = R$

$2\,\Omega = R$

Power: In an electrical circuit this is the rate at which electrical energy is transformed in a device

$$P = IV$$

P is power, in Watts (W), I is current (A), V is voltage, (V)

This eqⁿ can be combined with Ohm's Law to give 9 eqⁿ!
It's equation-ception!

$P = IV$

$V = IR$

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

$P = I(IR)$

$P = I^2R$

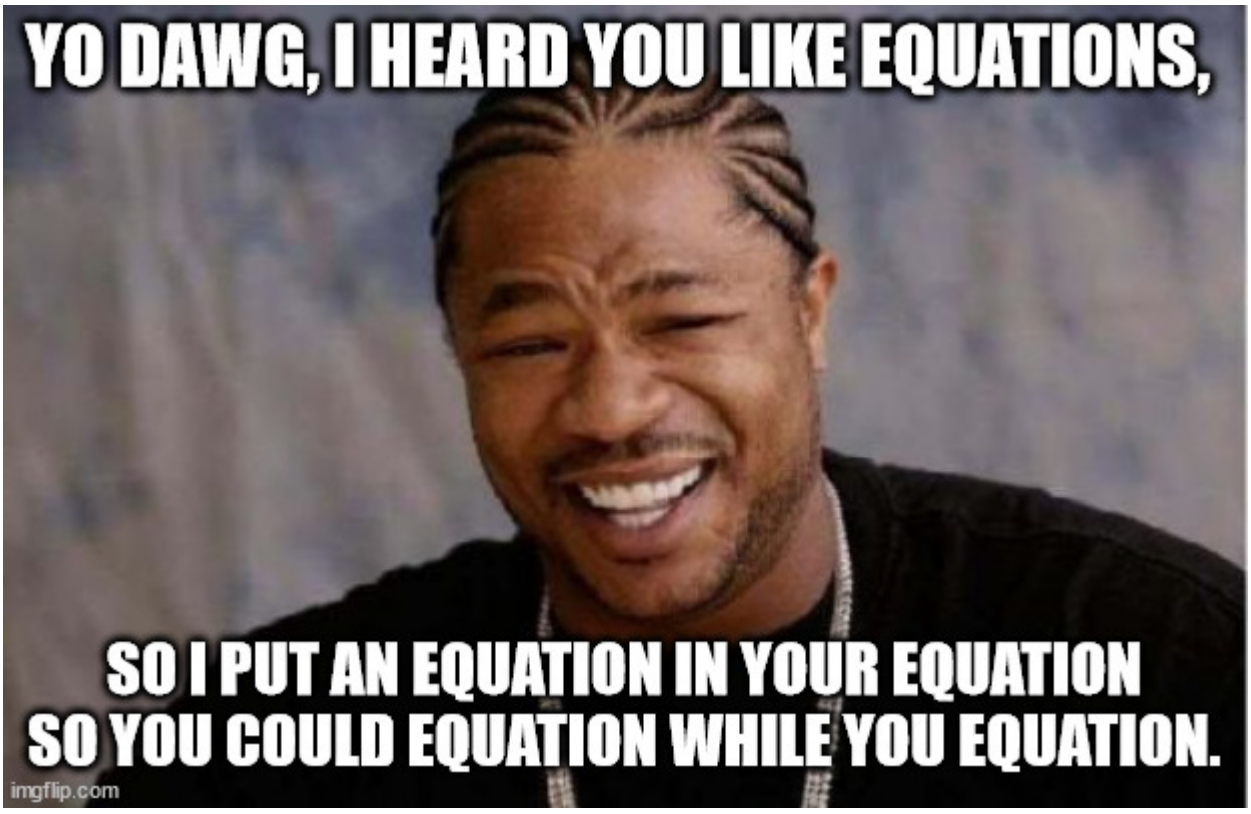
$P = \frac{V}{R}V$

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

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

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

See top circle of eqⁿ.



The current through a resistor is 4 A. If the voltage drop is 12 V, what is the power of the resistor?

Hint: 48 W

$I = 4 \quad V = 12 \quad P = ?$

$P = IV$

$= 4(12)$

$= 48 \text{ W}$

A 60 W light bulb is placed in a circuit with a voltage drop of 120 V. What is the resistance of the bulb?

Hint: 240 Ω

$P = 60 \quad V = 120 \quad R = ?$

$P = IV$

$60 = I(120)$

$\frac{60}{120} = I$

$\frac{1}{2} = I$

$V = IR$

$120 = \frac{1}{2}R$

$240\ \Omega = R$