What is electricity and what does it do?

Electricity is a form of energy and as such it can do work (expend, or convert, energy), it can be coded to carry information and when mistreated it can be lethal. At its basic level, electricity is visualised as the flow of electrons which carry charge from one place to another. In this way an analogy is often drawn with a flow of water:

water analogy	electrical term	unit	symbol	description
pressure	potential difference	volt	V	The strength behind the flow.
volume	charge	coulomb	C	the amount of flow
rate of flow	current	amp	A	flow per unit of time - 1 amp is 1 coulomb per second
friction	resistance	ohm	Ω	resistance to flow
energy	energy	joule	J	The energy carried by anything, water and electricity being just two examples
power	power	watt	W	energy per unit of time - 1 watt is 1 joule per second

Electrons are named after the Greek word for amber which the ancient Greeks used to generate static electricity. The electrons flow from the negative (or point of lower potential) to positive (or point of higher potential). However we conventionally think of electricity flowing from positive (or point of higher potential) to negative (or point or lower potential). The reason for this is that electrons are actually negatively charged carriers which can move from atom to atom in certain materials such as metals and by the time it realised that this was how it all happened the naming conventions had been established and so we're stuck with it as much as Britain (and a few other countries) are stuck with driving on the other side of the road from the rest of the world.

Since the charge on a single electron is so minute, the unit of the coulomb was devised to make the matter more manageable. 1 coulomb (symbol C) is equivalent to the charge on 6.241506×10^{18} electrons.

As with any flow there is energy carried which is proportional to the pressure and rate of flow of this fluid. And so we have control of a method of delivering enough energy to smelt steel on the one hand or a method by which we can transmit massive amounts of data across the globe.

How do these relate?

Ohm's law states this: V=IR or often V=IZ - the latter referring to impedance rather than

resistance.
i.e. voltage equals current divided by resistance (R), or impedance (Z).

This can be rearranged to: I=V/R or R=V/I or I=V/Z or Z=V/I P=VI for impedances.
From these you can calculate voltage if you know current and resistance (or impedance) or current if you know voltage and impedance etc.

We also have the formula P=VI, which defines electrical power as the product of voltage and current.
This can be rearranged to: V=P/I and I=P/V. With the application of a little algebra we can deduce:

$V=IR$	$V=P/I$	$V=\sqrt{(PR)}$
$I=V/R$	$I=\sqrt{(P/R)}$	$I=P/V$
$R=V^2/P$	$R=P/I^2$	$R=V/I$
$P=V^2/R$	$P=I^2R$	$P=VI$

This is a little spreadsheet that makes it all a bit easier PVI calc - Excel format or PVI calc - Open Office format.
For information and download of Open Office visit www.openoffice.org

resistance or impedance

Strictly speaking resistance concerns dc currents (ones that are constant and do not change) whereas impedance concerns ac currents (like audio signals) where voltages and currents do not always follow each other exactly as the current alternates and the impedance is usually dependent on frequency. For example a low pass filter's impedance will rise above the crossover point and thus attenuate frequencies above that point.
To the most part unless you want to get into the complexities of AC theory the concepts are interchangeable but you need to look at frequency bands when considering impedance. However be aware that if you put a multimeter across an 8Ω loudspeaker driver you are measuring the dc resistance which is likely to be about 6Ω or less.

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multipliers

In order to not have to write too many 0's and avoid all the errors that reading them can cause, a system of multipliers was adopted.

prefix	symbol	factor	index
giga	G	1,000,000,000	10^9
mega	M	1,000,000	10^6
kilo	k	1,000	10^3
milli	m	0.001	10^{-3}
micro	μ	0.000,001	10^{-6}
nano	n	0.000,000,001	10^{-9}

So any unit can be prefixed with a multiplier. For example:
1mV (one millivolt) is equivalent to 0.001V ($1x10^{-3}V$).
5.8kΩ (5.8 kilohms) is equivalent to 5800Ω ($5.8x10^3Ω$).
12MHz (twelve megahertz) is equivalent to 12,000,000Hz ($12x10^6Hz$).