Re: Explanation of Amps

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On 15 Jan 2005 20:18:23 −0800, "tuxtlequino" <tuxtlequino@yahoo.com> wrote:

>If E=IR can we just then increase the resistance and get as many volts
>as we want?

If you already know the I and you already know the R, then it allows you to compute the voltage which must be present across the two terminals in order to make that particular current through that particular resistance.

However, it is the more usual case in simple circuits that you have a given voltage and you either want to calculate the expected current, given some particular resistance... or else you want to calculate the desired resistor to use in order to achieve some given current value.

Your next question gets to this...

>The schematics in the book explains the number of volts (for example a
>9 volt battery), but they never mention the amps in the battery, how
>can we then figure out how much resistance do we need?

The battery supplies whatever current is required by the circuit. Most circuits will specify the desired voltage (say, 9 volts) and will have some particular effective resistance (not usually specified, though.) When you connect up the circuit, the battery presents a particular voltage to the circuit and the current simply is what it is, based on what the circuit requires.

If you hook up a 1k Ohm resistor to your 9V battery, 9 milliamps will flow. If you hook up a 10k Ohm resistor to your 9V battery, 0.9 milliamps will flow (or 900 microamps, as you prefer to imagine it.) The amount of current flowing depends on the "load" resistance. But the voltage at the terminals remains the same, with a battery −− 9 volts, in this case.

Batteries actually prefer it if the circuits require less current. They last longer and they provide the correct voltage for longer, as well. If the battery were an "ideal battery" it would provide 9 volts no matter what current is, but real batteries are limited.

A more useful specification for a battery, other than its voltage, is the total amount of energy it holds. Batteries don't really "hold amps" in them, they hold potential energy. As the energy is consumed, by way of the voltage and amps required over time, they gradually expire. While that takes place, their ability to maintain the specified voltage degrades somewhat and their ability to supply higher levels of current suffers. But it is the circuit that determines the "amps" that the battery needs to supply it. Not something inside the battery.

Still, batteries *do* have limitations in current. A car battery has a very high current rating and is able to supply very high currents into very tiny resistances, while still maintaining their voltage. A small hearing aid battery (a so−called button battery), on the other hand, may not be able to supply more than a milliamp or two and still hold their proper voltage, too. Something will suffer, if the circuit demands more than some tiny current limitation for those button batteries.

The voltage rating may be the same, but bigger batteries are usually able to handle more current for longer times, because they store more energy and because they are designed for higher current requirements. For example, a D−cell has the ability to supply much higher current than a AAA−cell does, while still holding a proper 1.5 volts. If the circuit requires too much for the AAA, for example, the AAA voltage itself may suffer *and* the battery may also warm up and the total lifetime of use will also suffer. In the same situation, the D cell may be perfectly fine supplying the higher current, not getting warm at all, and holding its proper voltage the entire time.

>If I get a LED that says in the package 2 Volts, and .005amp. I
>understand that I need to divide 7/.005 to figure out how much
>resistance I need. But why .005? Where did it came from, why, what is
>the resistance of the LED?

The LED "requires" about 2V to light up. With .005 amps (5 milliamps), the LED will be reasonably visible. Since your 9V battery has too much voltage for the LED to operate properly, you need to "throw away" part of that. To do so, you take the difference of what you have in the battery and what you need at the LED to compute the part to throw away. This is the 7 volts, as you said. Now, since you also want about 5 milliamps in the LED at the same time, and since the resistor is to be in series with the LED, whatever current the LED requires must come through the resistor. So the current through the resistor must be equal to the desired current through the LED. (Otherwise, the charge would have to "pile up" somewhere.) If you compute your resistor to be 7V/.005, or 1400 Ohms, and use that value then it will be true that the voltage taken away by the resistor (opposing the battery voltage) will be 7 volts *if* it turns out that 5 milliamps occurs. But if the LED takes a little less than 2 volts then the actual current through the resistor will be a little more and if the LED takes a little more than 2 volts, then the actual current will be a little less.

>Now, if I have a system of 9 volts (I bought an electric kit with a
>schematic explaning how it works!), and then there is a resistor for
>4.7MOhms, what is my amperage

If the resistor is hooked directly across the two battery terminals, then the current through the resistor will be 9V/4.7Meg or slightly less than 2 microamps.

>Would I use the same formula(e=ir) to figure out?

Yes, after some algebra to solve for I.

>Does the use of capacitors change my amperage (I have seen them in my circuit!)?

It makes your current time−dependent. That's too complex for you to worry about, just yet.

Jon