Electricity - Resistivity and Conductivity

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Resistance is what causes things to heat up as electric current flows throw an object. Everything has a resistance. Everything has a resistance - though this can be vanishingly small or very large.

$$V = IR \text{ so } R \Rightarrow \frac{V}{I} \text{ as you know of couse.}$$

If resistance is a measure of how difficult it is for current to flow then logically 1/R would be a measure of how easy it is for current to flow. This quantity, 1/R is known as conductance and helpfully given the symbol G. The units are 1/Ω or siemens, S.

As G = 1/R it means that G = I/V

Factors Effecting Resistance
For an easy component, ie a resistor a a wire, there are three things that can effect the value of its resistance.

- Length (L)- if its longer, more work has to be done to get the current 'to the end' - so R is bigger
- Cross Sectional Area (A) - If the wire is wider it is easier for current to flow
- Resistivity - this is a constant for a given material at a given temperature. Resistivity is given the symbol 'rho' ρ.

These all combine into this equation:

$$R = \frac{\rho L}{A}$$

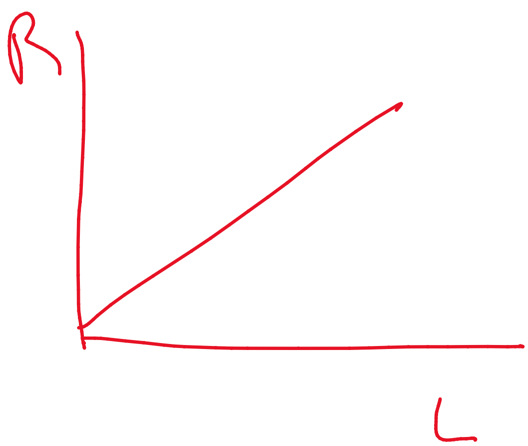
ρ for copper at 25°C = $1.72 \times 10^{-8}\ \Omega m$

The conductivity of a material is - yes - the inverse of the resistivity. It is defined as being the 'conductance of a 1m length with a 1m2 area. It has a different constant which is simply 1/resistivity and given the symbol σ

Perhaps unsurprisingly then we get:

$$G = \frac{\sigma A}{L}$$

To find ρ - do expt vary L, measure $\frac{V}{I}$ to R



grad $= \frac{R}{L}$

& $R = \rho \frac{L}{A}$

so $\frac{R}{L} = \frac{\rho}{A}$

$\therefore \rho = \left(\frac{R}{L}\right) A$

gradient.