Electromagnets

1. Voltage and resistance

CONCEPT 3

RESISTANCE

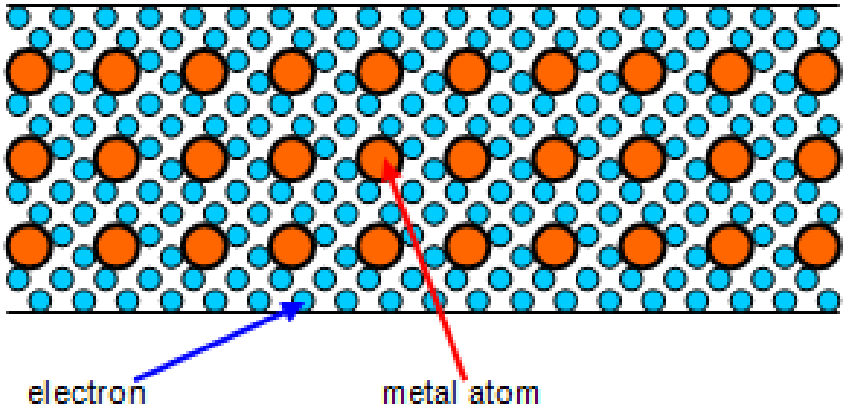
NOTES

Resistance can in some cases cause major issues (computers over heating), but the can also be incredibly useful (toasters and electric heaters).

The idea of resistance comes from German Physicist Georg Simon **Ohm,** whose last name gives rise to the unit of resistance. His work was originally received coldly until about 10-15 years later when people starting using it and saw its worth.

Resistance or 1 Ohm is defined when 1 volt produces a current of 1 amp. At this point current will be explored in the next module, but can we stated as flow of charge (due to it being 'pushed' – voltage).

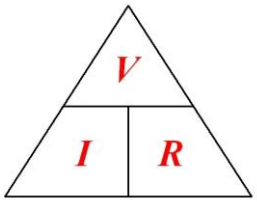
We need to think about resistance on a very small scale:



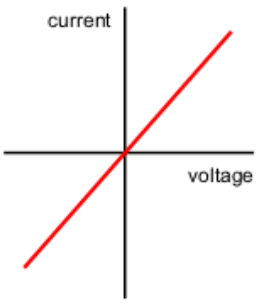
This model shows that inside a conductor, there are bits that are 'stationary' (metal atoms) and there are the bits that 'move' (electrons). It is the second part of this that is responsible for energy being conducted in metals – either as heat or electricity. Resistance is the physical repercussion of the collisions between the electrons and the metal ions – so as the voltage increases (the push on the electrons) the current increases (the flow of electrons) [see equation triangle and graph below]. The unintended consequence of this is the energy transferred to the metal ions (the metal itself) which is then lost to the surroundings as heat. There is a point at which even if the push is increases (voltage), there will be no increase in the flow (current). At this point the material is said to be non-ohmic (doesn't follow Ohms law).

Ohms law is the simple proportionality between push and flow – Voltage and Current.

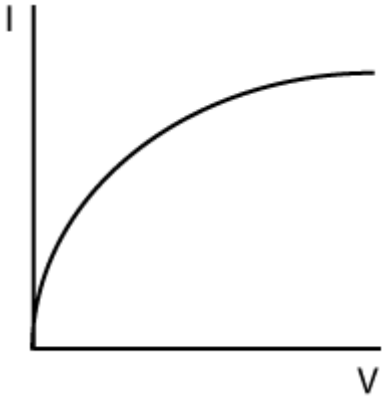
$V = I\,R$



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



The point at which there is no proportionality would display a graph like this:



An example of a thing that would do this would be a filament lamp.