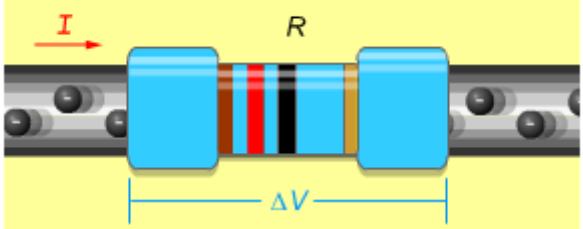
Ohm's law and resistance

Resistance: The ratio of the potential difference across a conductor to the current through it.

Resistor: An electrical component often used to control the amount of current flow.

Resistance is defined as the potential difference across two points on a conductor divided by the current flowing through the conductor. At the right, we use a common electrical component called a resistor to illustrate this concept. There is a potential difference across the resistor and current flowing through it. Divide the potential difference by the current and you have calculated the resistance of this resistor.

equation 1



Ohm's law: potential difference and current

$$\Delta V = IR$$

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

ΔV = potential difference

I = current

R = resistance

Units of resistance: ohms (Ω), volts/ampere

The resistance of many resistors is constant. These resistors are made of *ohmic* materials, which are empirically known to obey Ohm's law. Increase the potential difference and the current increases proportionally. The resistance does not change. The linear relationship between potential difference and current is shown as the first equation in Equation 1.

Since resistance equals potential difference divided by current, its unit, the ohm, is volts per ampere. Resistance is represented by Ω, the Greek letter omega.

Resistors are not the only components that resist the flow of current. The filament in a light bulb or the coils of an electric hot plate both function as resistors. The term "resistor" broadly refers to any element that is a source of resistance.

Again, water is a good analogy. The potential difference driving current in a wire resembles the pressure exerted on water in a pipe. Increase the pressure, and the water flow increases. Different pipes have different amounts of resistance. For instance, one with a rough interior wall would have greater resistance to water flow than one with a smooth wall.

Materials that do not obey Ohm's law are called *non-ohmic*. Many components used in modern circuitry are made of non-ohmic materials. For instance, a diode has little resistance to current flow in one direction, and great resistance to current flow in the other.

Georg Ohm published his major work, including what we now know as Ohm's law, in 1827. His theories were greeted with skepticism and his career was slow to progress. Why it took so long for his work to be appreciated is hard to say. Perhaps it is because the law is empirical as opposed to a fundamental law of nature. It is fair to note that many major leaps forward in physics were met with skepticism and opposition.

Questions:

1) What are the units of resistance? Write the symbol and the word.
2) What is the difference between an Ohmic resistor and a non-ohmic resistor?
3) If you increase the resistance of an ohmic resistor what will happen to the current through that resistor?