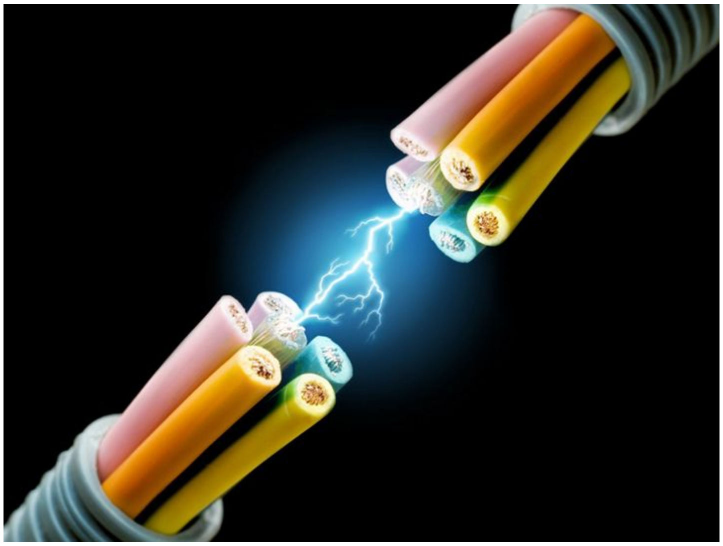
Voltage

Do you have an intuitive idea of voltage (V), current (i), and resistance(Ω)?



Here's an analogy that may help you understand the difference between the three.

Picture a bunch of electrons in one bucket. And a lack of electrons in the other (a lack of electrons is really a pile of protons). As such there is a charge between the buckets.

The electrons will want to leave one bucket and go to the other (electrons hate each other).

This desire to go to the protons is voltage.

If we connect the buckets, the amount of electrons that make the journey is current.

If we put something in their way, that is resistance.

We do not need a lot of voltage to make a current through a small resistance. If we want to do do a larger job, we need more voltage to encourage more electrons to make the journey.

ie: You being hungry is voltage. You going to the store is current. The distance to the store is resistance. We can change these parameters to cause you to go or not.

$$V = IR$$

voltage = current * resistance
*desire to go = amount that go * how hard it is to go

Using voltage to accelerate charges:

Potential energy may be determined via voltages:

$$\Delta V = \frac{\Delta E_p}{q}$$

An electron begins at rest in a region of 100V and is accelerated towards a plate at 500V. What speed will the electron have when reaching the 500V plate?

Apply conservation of Energy:

$$(E_k + E_p)_0 = (E_k + E_p)_f$$

Hint: 11.9Mm/s

We have another parallel with gravity -- we can look at the voltage of a point charge.

$$V = \frac{kq}{r}$$

Find the potential difference (ΔV) about a 6.0×10^{-6} C charge.

Note: voltage is scalar. Respect ± signs.

Hint: 9kV

A proton travelling at 2.0Mm/s begins at 4kV and ends at 6kV. What is its final velocity?

Hint: use conservation of energy

$E_p = qV$

$v_f = 1.9$Mm/s

What would be v_f if the above question was a neutron?

Here's a tricky one…

A proton moving at $3.0 \times 10^5\ \frac{m}{s}$ enters a region of voltage. It exits at $2.0 \times 10^4\ \frac{m}{s}$. What potential difference did the proton move through?

Hint: naw, look for it on the test.

A proton moving at $3.0 \times 10^6\ \frac{m}{s}$ is far away from an aluminum nucleus. How close will the proton get?

Hint: $4.0 \times 10^{-13}\ m$