Electricity basics

Current, I

Electrical current is the rate of flow of charge in a circuit. Electrons are charged particles that move around the circuit. So we can think of the electrical current as the flow of electrons, not so much the speed but the number of electrons moving in the circuit. If we imagine that electrons are students in a corridor, and a wire of a circuit is the corridor itself, the current is how many students are passing by in a set time.

Current is measured in Amperes (or Amps), A

Charge, Q

The amount of electrical charge is a fundamental unit, similar to mass and length and time. From the data sheet we can see that the charge on one electron is actually -1.60×10^{-19} C. This means that it takes 6.25×10^{18} electrons to transfer 1C of charge.

Charge is measured in Coulombs, C

Voltage/Potential Difference, V

Voltage, or potential difference, is the work done per unit charge.
1 unit of charge is 6.25×10^{18} electrons, so we can think of potential difference as the energy given to each of the electrons, or the pushing force on the electrons. It is the p.d. that causes a current to flow and we can think of it like water flowing in a pipe. If we make one end higher than the other end, water will flow down in, if we increase the height (increase the p.d.) we get more flowing. If we think of current as students walking down a corridor, the harder we push them down the corridor the faster they move and more pass by each second.

Voltage and p.d. are measured in Volts, V

Resistance, R

The resistance of a material tells us how easy or difficult it is to make a current flow through it. If we think of current as young students walking down a corridor, it would be harder to make them flow if we added some college rugby players into the corridor. Increasing resistance lowers the current.

Resistance is measured in Ohms, Ω

Current, charge and time

There are three equations that we need to be able to explain and substitute numbers into.

$$\boxed{I = \frac{\Delta Q}{\Delta t}}$$

Current is the rate of change of charge per second and backs up or idea of current as the rate at which electrons (and charge) flow.

This can be rearranged into

$$\Delta Q = I\Delta t$$

which means that the charge is equal to how much is flowing multiplied by how long it flows for (time in seconds).

Potential difference, energy and charge

$$\boxed{V = \frac{E}{Q}}$$

This says that the voltage/p.d. is the energy per unit charge. *The 'push' of the electrons is equal to the energy given to each unit of charge.*

Potential difference, current and resistance

$$\boxed{V = IR}$$

This says that increasing the p.d. increases the current for same resistance. *Increasing the 'push' of the electrons makes more flow.*
It also shows us that for constant V, if R increases, I gets smaller. *Pushing the same strength, if there is more blocking force less current will flow.*