Jan 8, 2020

S1 Science: The Flow of Electricity

When a wire is connected to the terminals of a source (i.e. battery), a complete path called a **circuit** is formed. Electric charge (electrons) can flow through a circuit.

Open Circuit
No electricity flows.

Closed Circuit
Electricity flows.

What is current?

The atoms in conductors such as copper wire have one or more free electrons of the outer ring constantly flying off. Electrons from other nearby atoms fill in the holes. There are billions of electrons moving aimlessly in all directions, all the time in copper wire and other types of conductors. When voltage is applied to a conductor it drives these free electrons away from the negative force toward the positive source. This movement or flow of electrons is known as a **current**. **Electric current** is the rate at which charge passes a given point. The symbol for current is **I**.

I = electric current *Measured in Amperes or Amps or A.*

An ampere is the measurement of the number of electrons going past a certain point in one second.

Scientists use **ammeters** or **galvanometers** to measure electric current. Electric current flows much more easily in conductors than insulators. The electric current travels extremely fast, at near the speed of light, 300,000,000 m/s. Electric current only flows in a closed circuit (see page 26). The greater the current, the faster the electrons are passing through it.

What is voltage?

Voltage should be more correctly called "**potential difference**". It is actually the Electron Moving Force in electricity (**emf**). Voltage supplies the force and energy that pushes the electrons through the circuit. If there was no force on the electrons, the electrons would not move and there would be no current. When the force causes the electrons to move, an electric current is created.

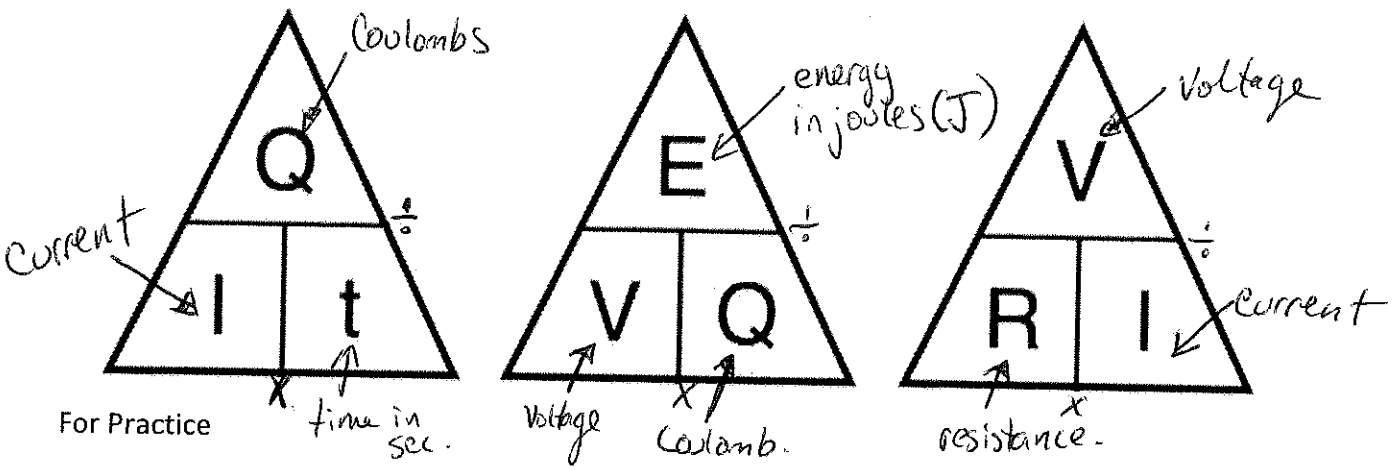
voltage = potential difference = emf

The greater the voltage, the greater the force on the electrons and the faster the electrons will flow and the greater the current.

V = voltage *Measured in volts or V.*

Resistance
Force acting against electrons. R = resistance
measured in ohms or Ω

Voltage, Current, and Resistance Calculations



For Practice

1. The potential difference between the two terminals on a battery is 9 volts. How much work (energy) is required to transfer 10 coulombs of charge across the terminals?

$V = 9V$ $\quad E = V \times Q$

$E = ?$ $\quad E = 9 \times 10$

$Q = 10C$ $\quad \boxed{E = 90J}$

2. If there is a current of 10 amperes in a circuit for 10 minutes, what quantity of electric charge flows in through the circuit?

Coulomb.

$I = 10A$ $\quad Q = I \times t$

$t = 10min = 600sec.$ $\quad Q = 10 \times 600$

$Q = ?$ $\quad \boxed{Q = 6000C}$

3. What voltage produces a current of 50 amps with a resistance of 20 ohms?

$V = ?$ $\quad V = R \times I$

$I = 50A$ $\quad V = 20 \times 50$

$R = 20\Omega$ $\quad \boxed{V = 1000V}$