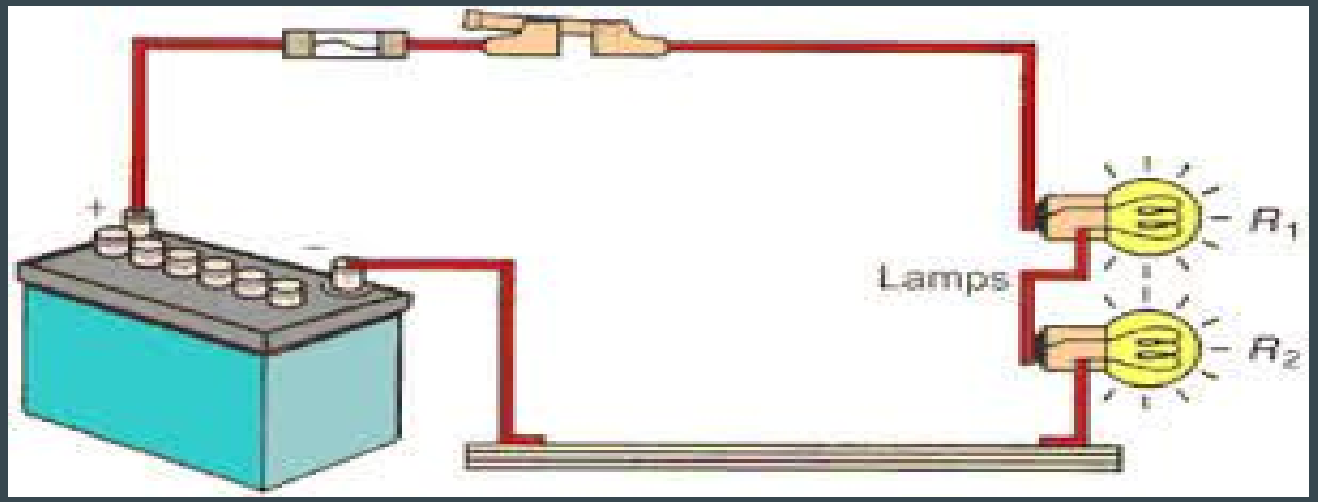
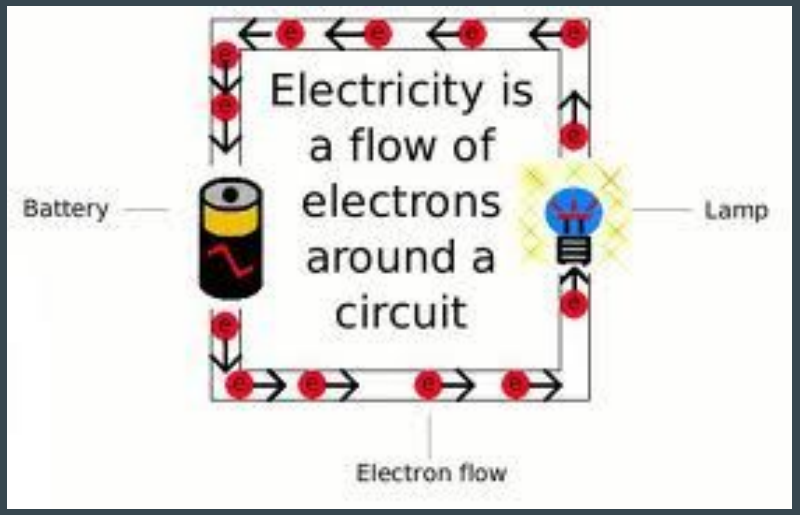
Circuits



Electricity is simply the movement of electrons through material

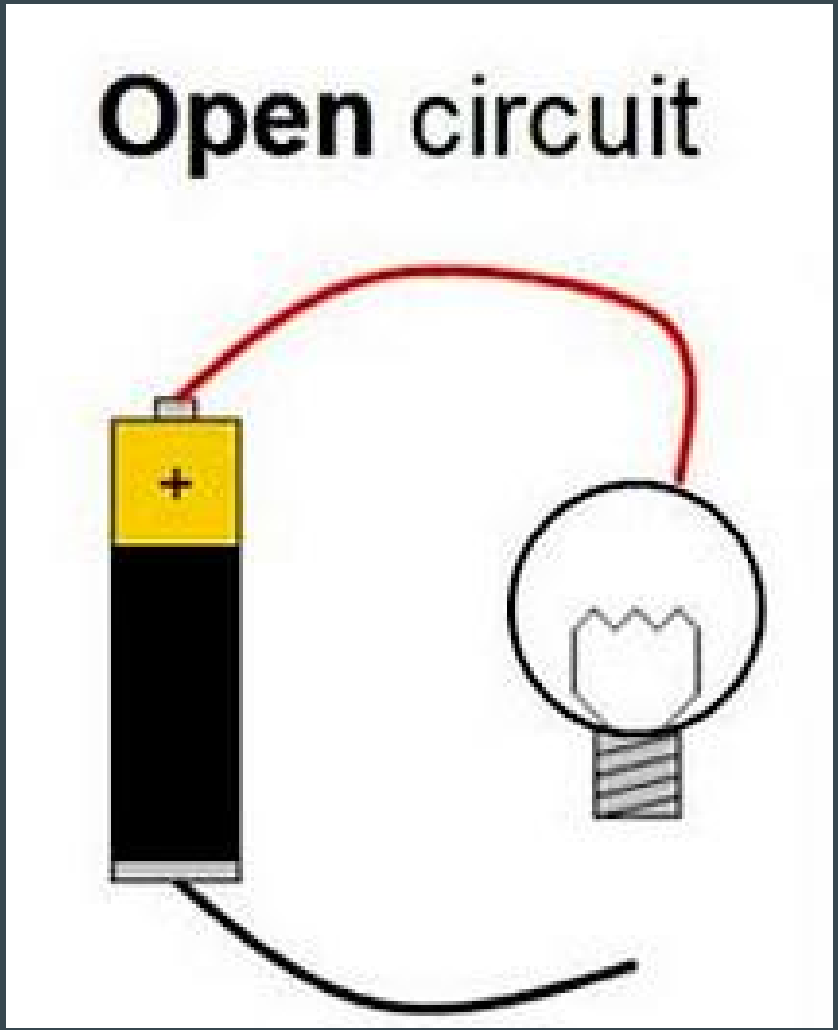
Slow motion lightning

A circuit must provide a continuous path for electricity to travel along



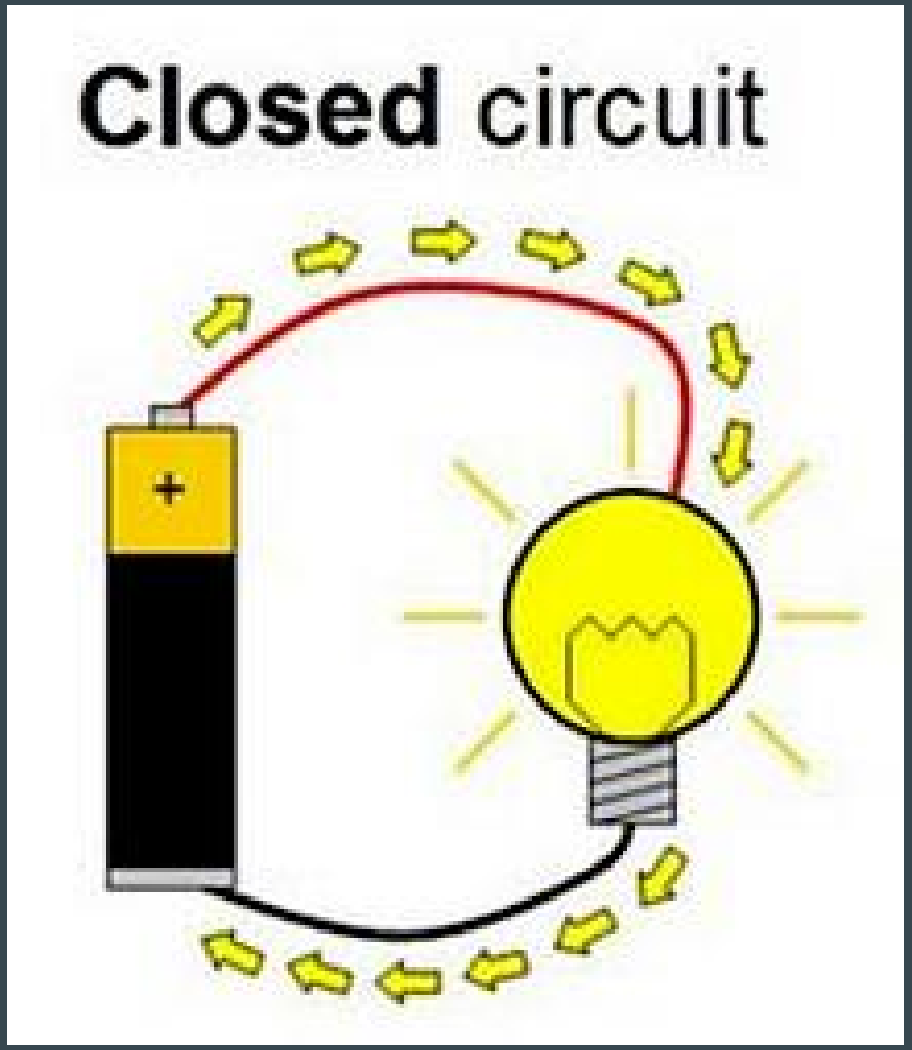
Open Circuit: Electron flow is interrupted (the pathway is broken).
-electricity will NOT be able to work

e.g. Open *switches* break the metal – to – metal connections of a closed circuit.



- **Closed Circuit**: Electrons travel in an unbroken pathway.
  -allows electricity to flow in a current

- e.g. Turning on a light switch creates a closed circuit.



Electric circuits are composed of 4 parts:

1. **Source** – where the electrical energy comes from

   (e.g. battery, outlet, generator)

Electric eels

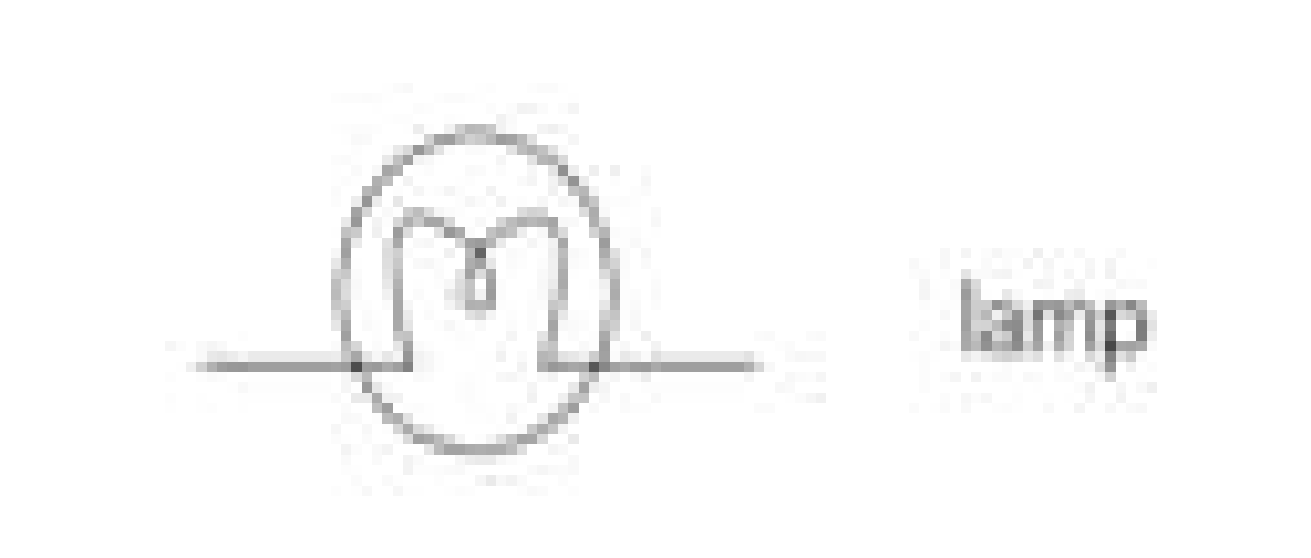
- *In a circuit drawing: long line= positive. Short line= negative*

2. Conductor – Wire or material through which electricity flows *(pathway)*

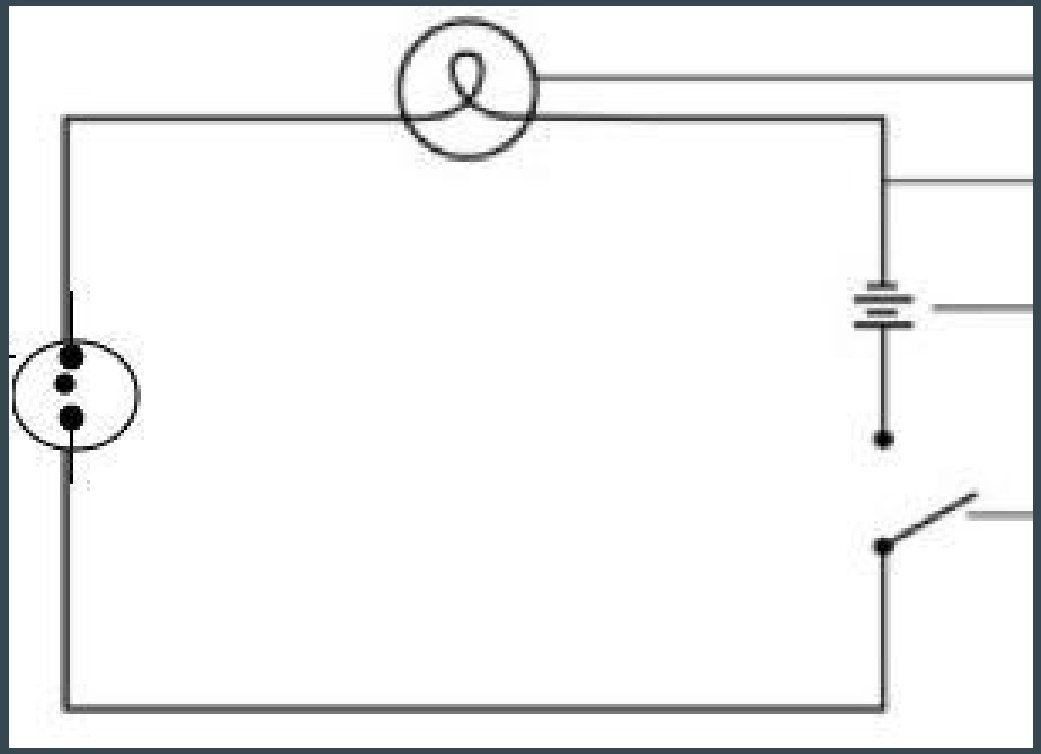
<u>3. Control</u> – Switch which turns devices *on* or *off*

<u>4. Load</u> – The device that converts the electrical energy into ‘work’

(e.g. light bulbs, speakers, motors, ovens)



Circuit Diagrams



Load (lamp)

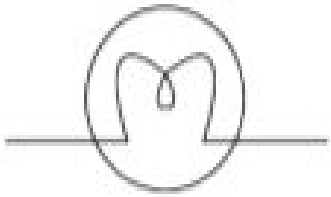
Conductor (wire)

Source (battery)

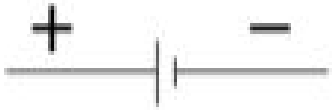
Control (switch)

Common symbols Include:

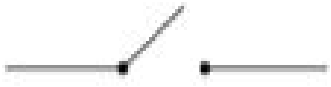
conducting wire



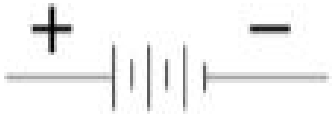
lamp



cell

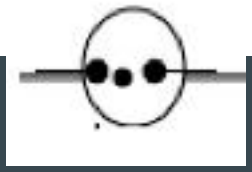


switch



battery

resistor



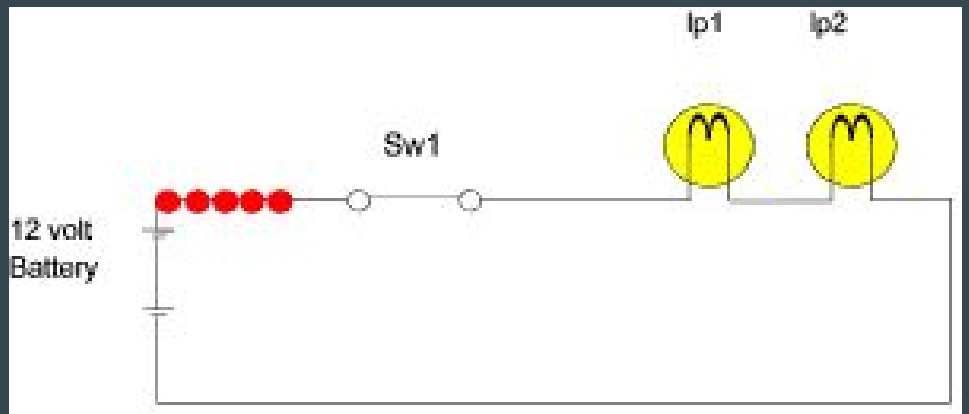
Motor

Series vs. Parallel

There are two types of circuits

1. **Series Circuit--**electrons flow in only one pathway

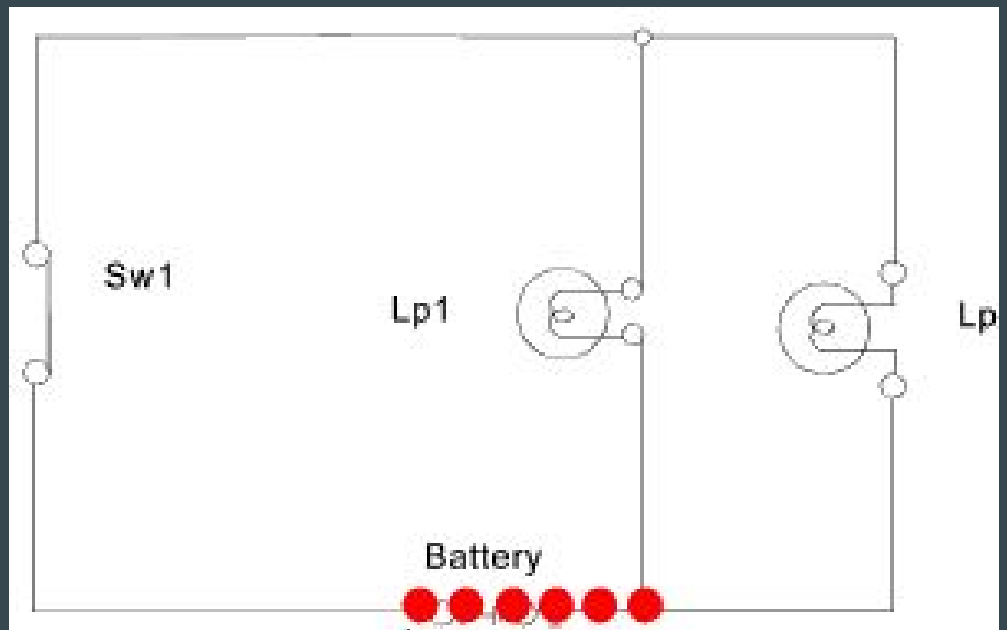
e.g. Christmas lights used to be built in series. If one bulb burnt out, all the lights would go out because the pathway was broken



2. Parallel Circuit--electrons flow in two or more pathways.

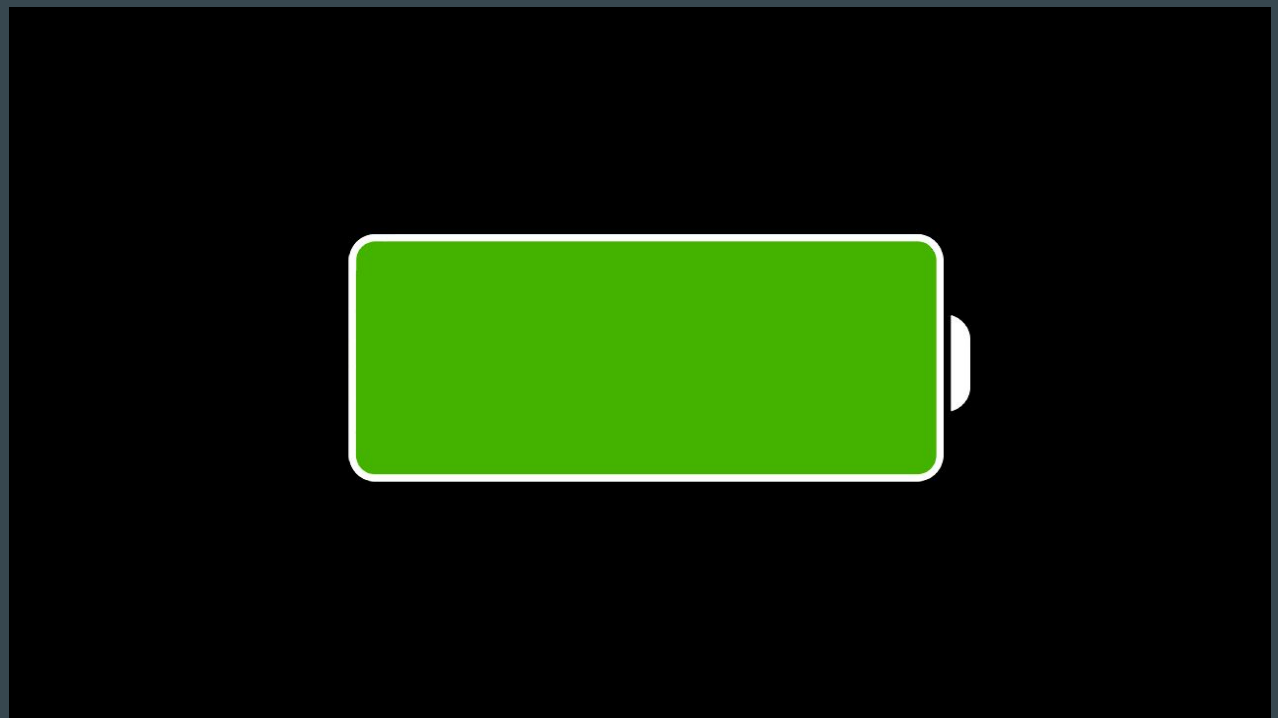
e.g. Christmas lights that will stay on when a bulb burns out or is removed.

Causes reduced resistance in a circuit but the battery discharges twice as fast



Cells vs Battery

A cell has two charged points where electricity can flow through. These are the positive and negative ends, called electrodes



If there are two or more cells connected, a battery is created. If the batteries are connected in series (all in a line) the voltage of the new battery is amplified

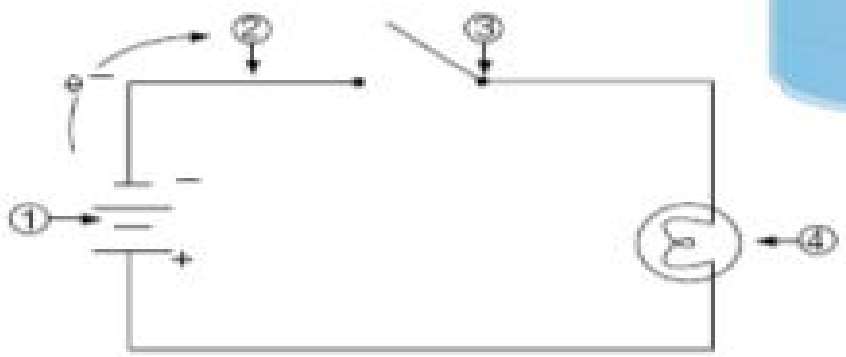
244 9V batteries

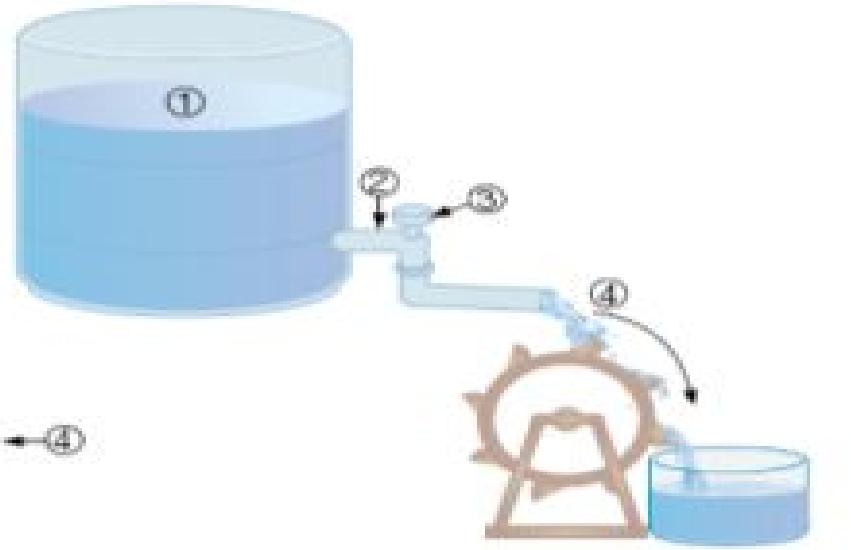
Rivers of Electricity

Electric circuits are often compared to water systems.

Electric charge is like the water, as it flows (input) it makes changes in the energy that results (output)

(a) highest energy
(b) lowest energy
(c) control
(d) load





Draw:

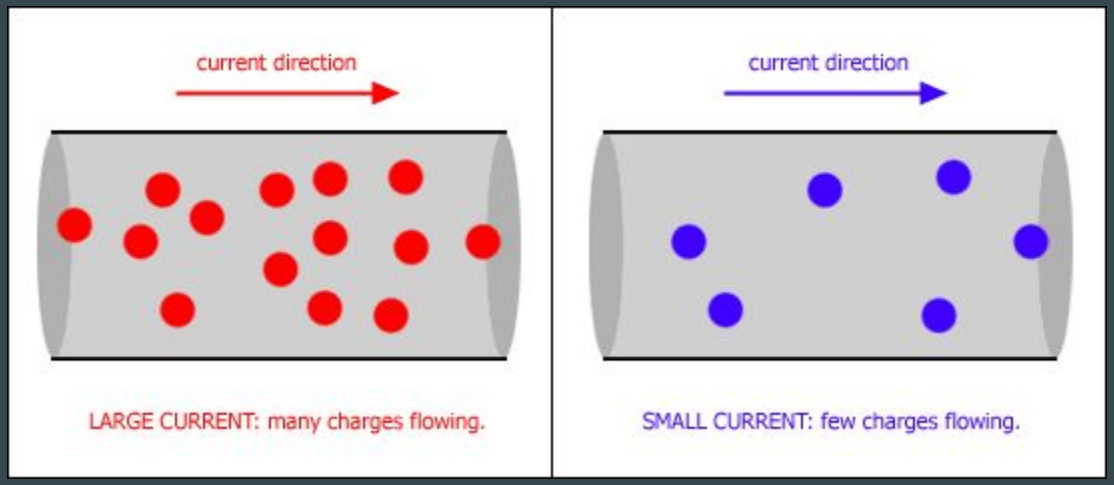
A circuit containing a battery of four cells with a switch and lamp

Draw a circuit that has 2 lamps and a resistor, all of which is powered by a two cell battery. It also has a switch to turn it all on and off.

Current

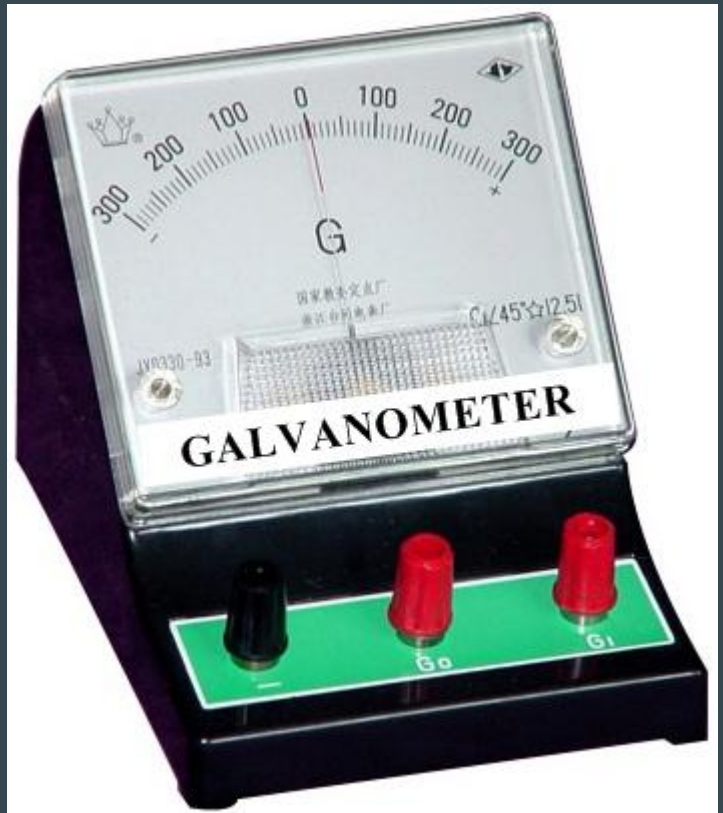
The steady flow of charged particles is called current (I).

The rate at which an electrical current flows is measured in amperes. This flow varies from a fraction of an ampere to many thousands of amperes, depending on the device.



An instrument used to measure very weak electric current is called a galvanometer. It measures in milliamperes.

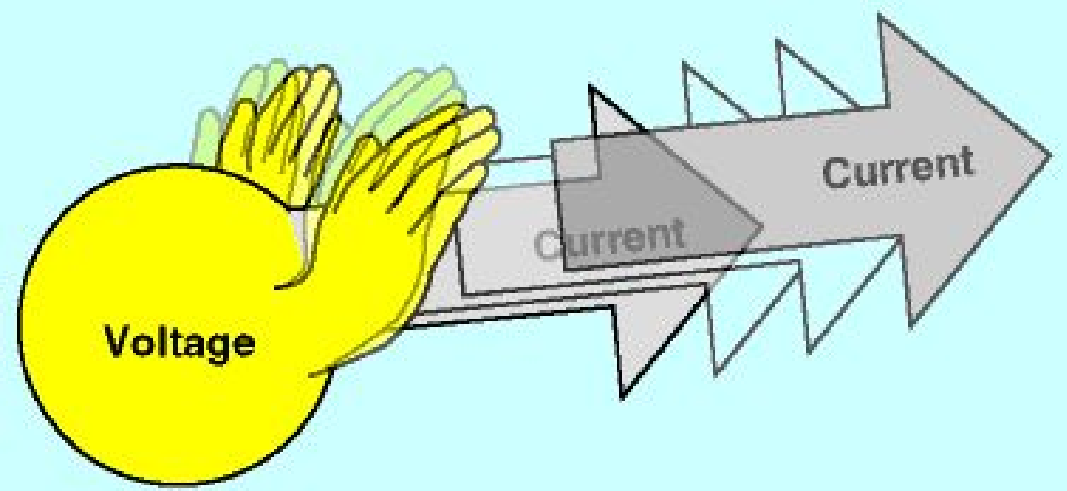
Larger currents are measured with an ammetere. It measures in amperes.



Voltage

Electrical energy is the energy carried by charged particles.

Voltage is a measure of the difference in energy per unit of charge between one point in the circuit and another point in the circuit.



The higher the energy (voltage) of each charged particle, the greater the potential difference or ability of electrons to move their way through a circuit.

Also called potential difference.

Voltage units are volts (V).

A simple way to measure voltage is with a voltmeter. (red to positive (+) and black to negative (-))

Some voltmeters can measure a wide range of voltages. These devices should be used with caution, so that the sensitive needle is not damaged (by testing a low range with high voltage).