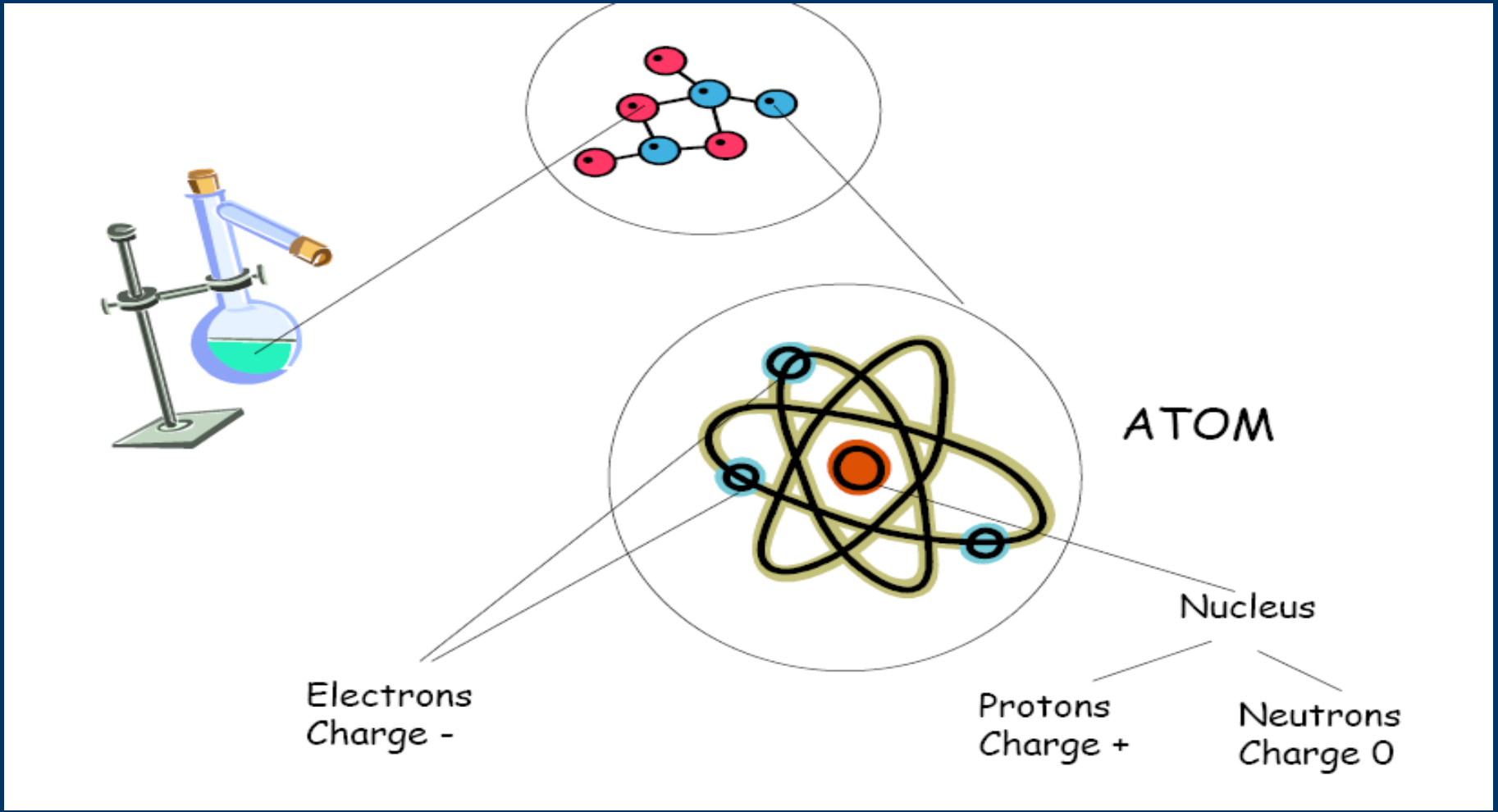
ELECTRICITY

- WHAT´S ELECTRICITY
- CONDUCTORS AND INSULATORS
- ELECTRICAL CIRCUIT
- ELECTRICAL CURRENT
- VOLTAGE
- RESISTANCE
- OHM¨S LAW

WHAT IS ELECTRICITY?

MOLECULES



To understand static electricity, we have to know the atom.All of them are made up of a "nucleus" situated in the middle of each atom. The nucleus contains two important kinds of tiny particles, called protons and neutrons. Orbiting around the nucleus are smaller particles called electrons

Imagine you have scales…

It's **un-balanced**

It's **balanced**

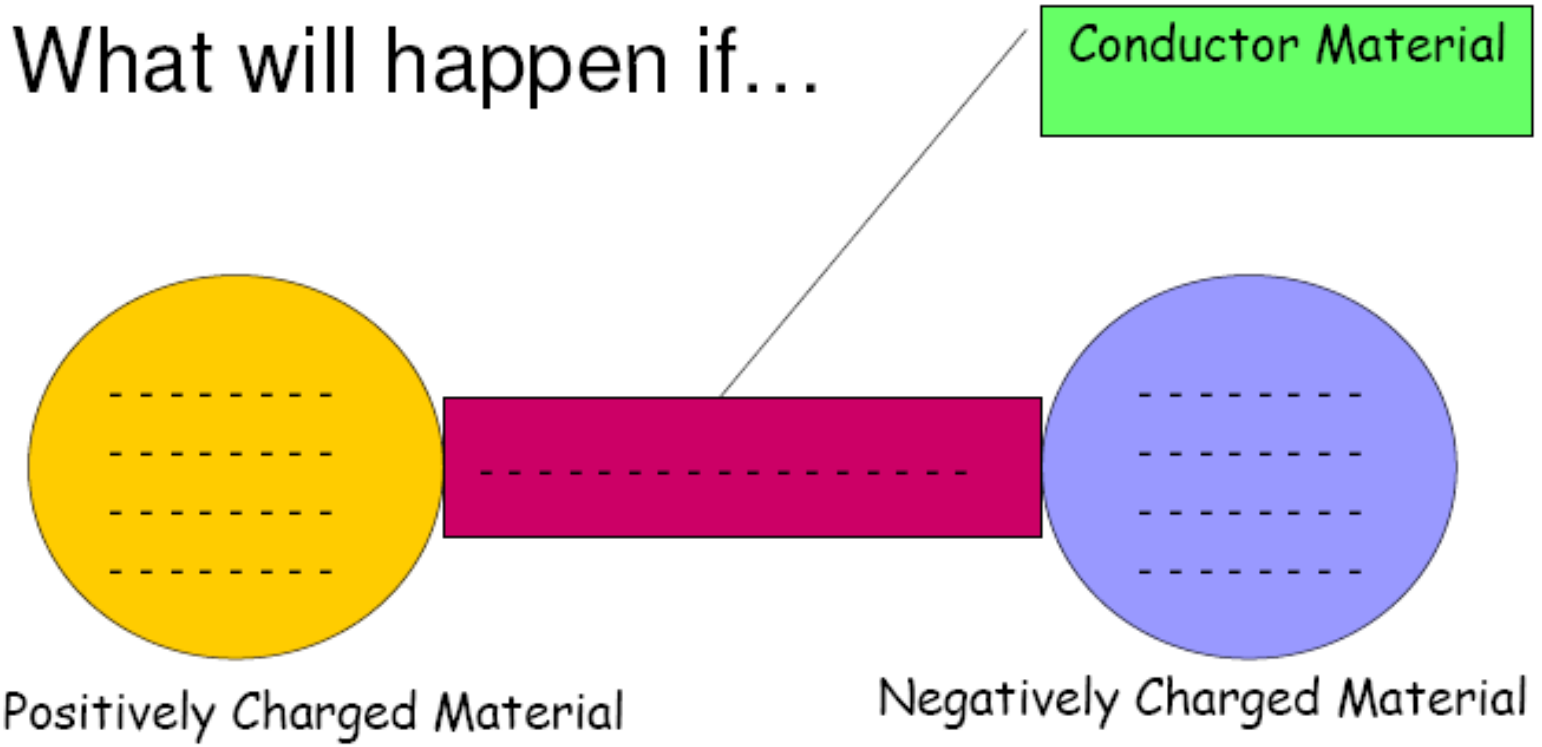
If an atom has the same number of electrons as protons, will it be balanced or un-balanced?

When an atom has **n°electrons=n°protons** is balanced. It's called **STABLE ATOM**.

What we must know about atoms

- **Electrons** are moving around the **nucleus**
- **Protons** and **neutrons** do not move around the **nucleus.**
- *A* **stable** atom has the **same** number of **electrons** than **protons**
  - If an atom has **more** electrons than protons: it has **Negative** charge
  - If an atom has **fewer** electrons than protons: it has **Positive** charge
  - If an atom has **same** number of electrons as protons: it does **not** have charge.

- What will happen if…



…excess electrons move from negatively charged material to positively charged material.

CONDUCTORS AND INSOLATORS

In conductive materials, such as metals, the outermost electron in the atom is basically free, so it is very easy for it to leave the atom and move around in the space between the atoms.

Conductors are made up of atoms whose electrons (conduction band) are able to escape from the atom's influence. In a metal, some electrons are not stuck (fixed) to any particular atom and are free to wander in the metal. For instance, the copper, the most used conductor in the world, there is usually a free electron from every copper atom. As the electrons move, they collide with the atoms and thus meet resistance to their motion. The greater the number of collisions the greater the resistance.

Examples of conductors:

- Gold, Silver, Copper, Aluminium
- Tap Water, Animals, Trees ..

On the other hand, in Insulator materials, such as glass, the outermost electron in the atom is tightly bonded to the nucleus by a electrostatic force. In this case, most electrons are attached to particular atoms. Almost none are free to wander through the material, and this prevent the flow of electricity.

Examples of insulators:

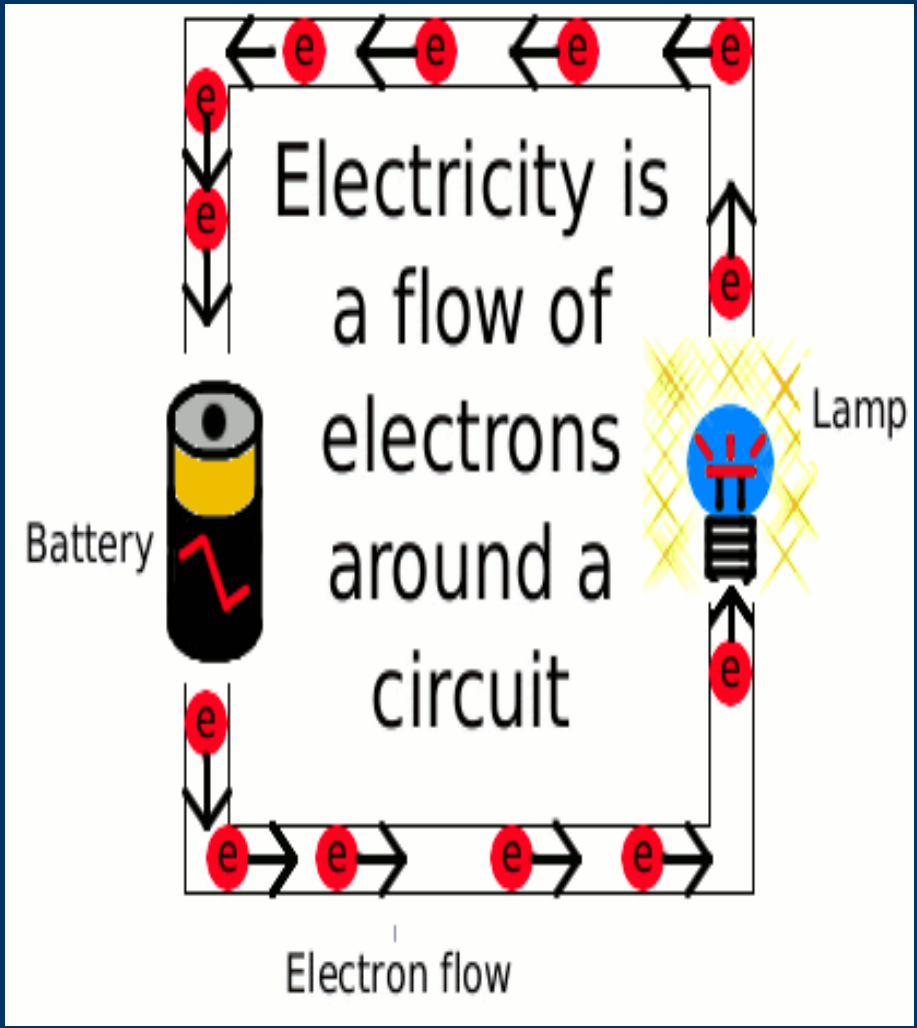
- Glass, Porcelain, Plastic, Rubber

ELECTRICITY.MOVING CHARGES

Energy changes in a simple electric circuit moving electrons through a conductor

When current flows in a conductor, energy is given out at every point in that conductor. This energy comes from the battery (or other source, e.g. a generator) that is driving the current through the conductor.

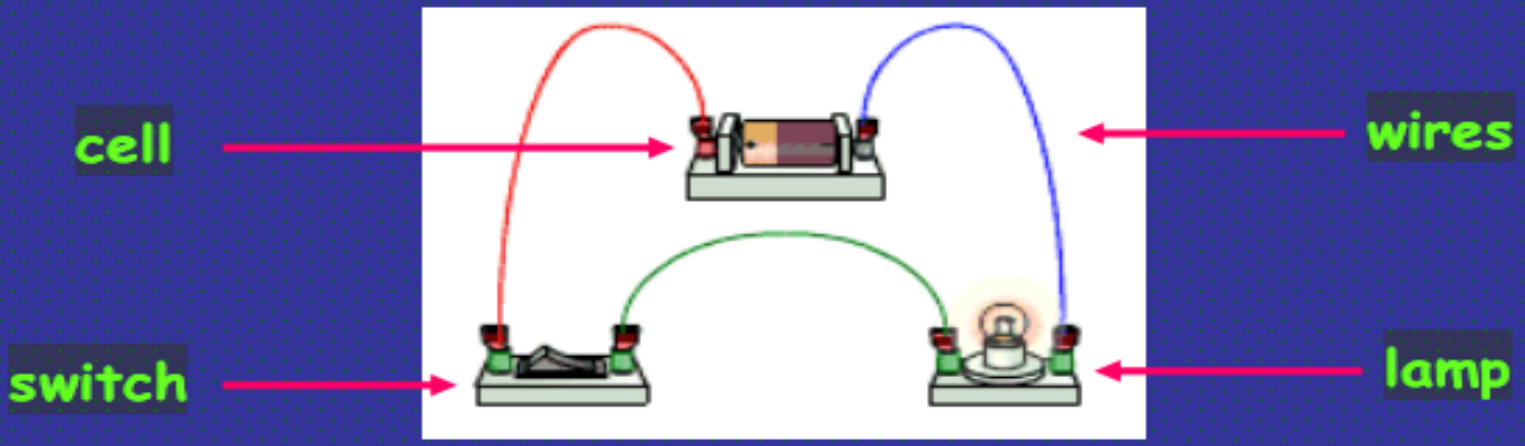
I



ELECTRICAL CIRCUITS

simple circuits

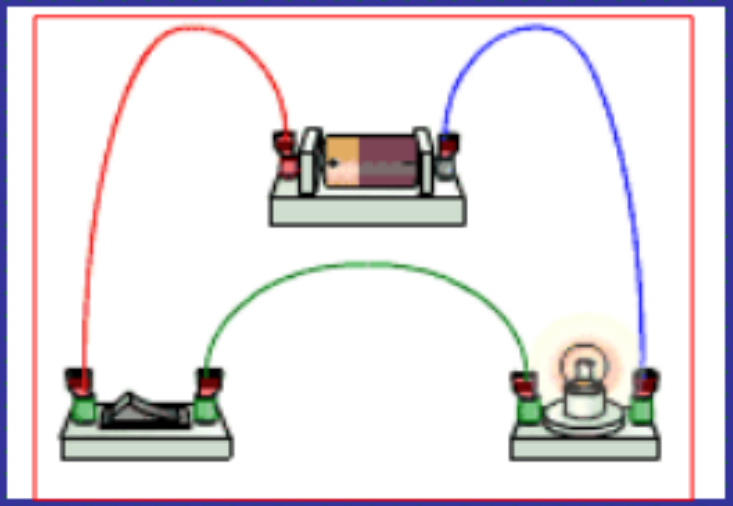
Here is a simple electric circuit. It has a cell, a lamp and a switch.



To make the circuit, these components are connected together with metal connecting wires.

simple CIRCUITS

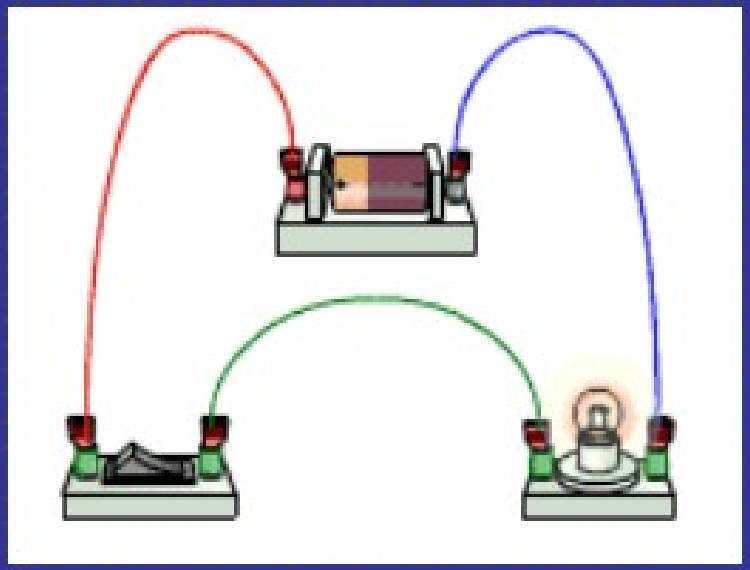
When the switch is closed, the lamp lights up. This is because there is a continuous path of metal for the **electric current** to flow around.

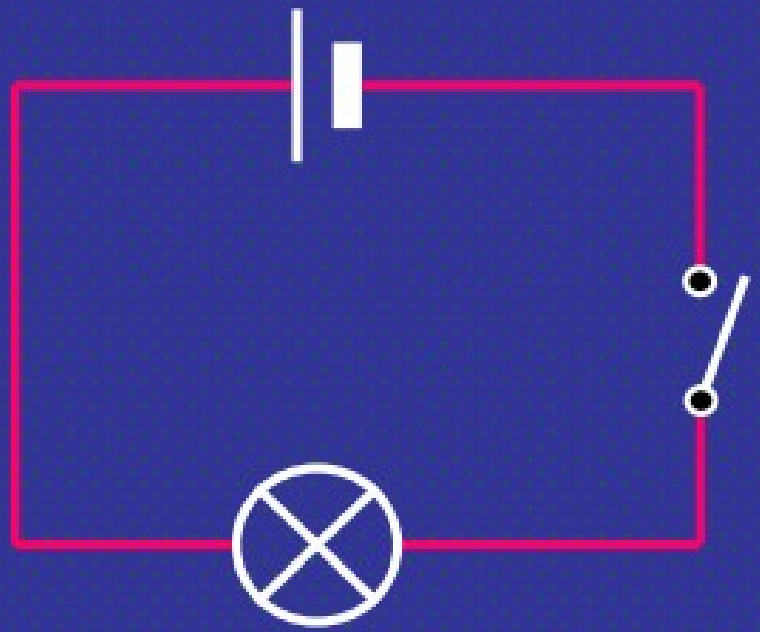


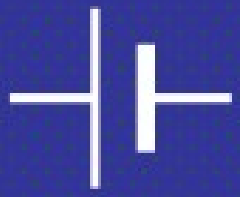
If there were any breaks in the circuit, the current could not flow.

circuit diagram

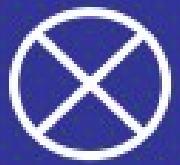
Scientists usually draw electric circuits using symbols;







cell



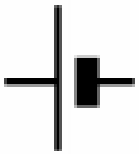
lamp

switch

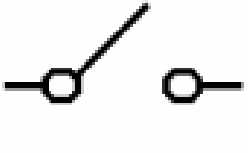
wires

circuit diagrams

In circuit diagrams components are represented by the following symbols;


cell


battery


switch


lamp


buzzer

ammeter

voltmeter

motor

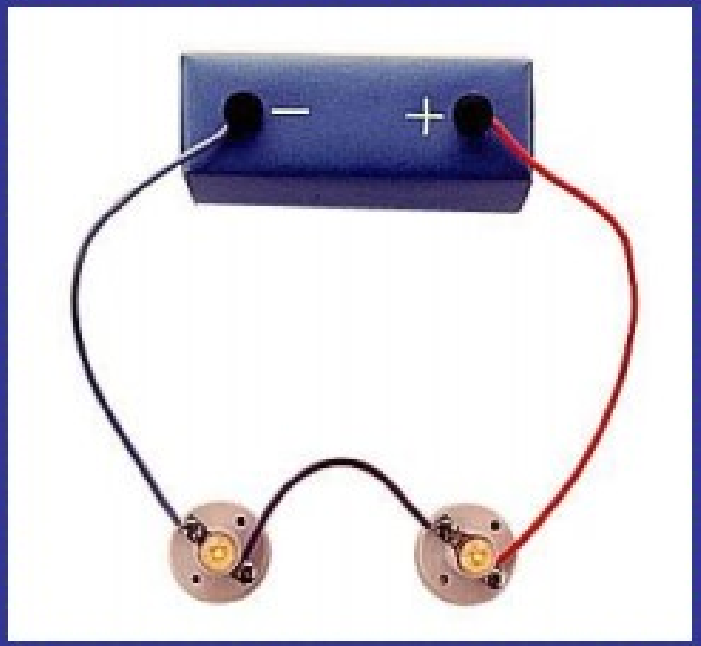

resistor


variable resistor

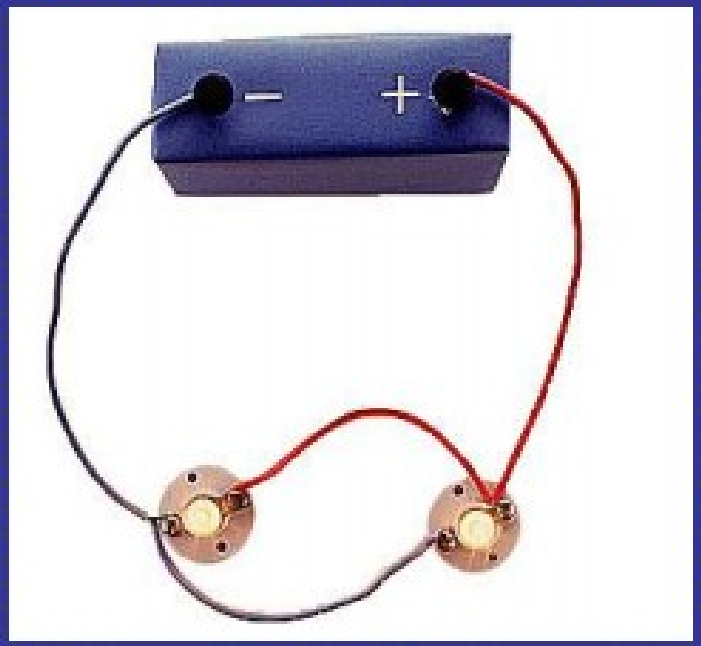
types of circuit

There are two types of electrical circuits;

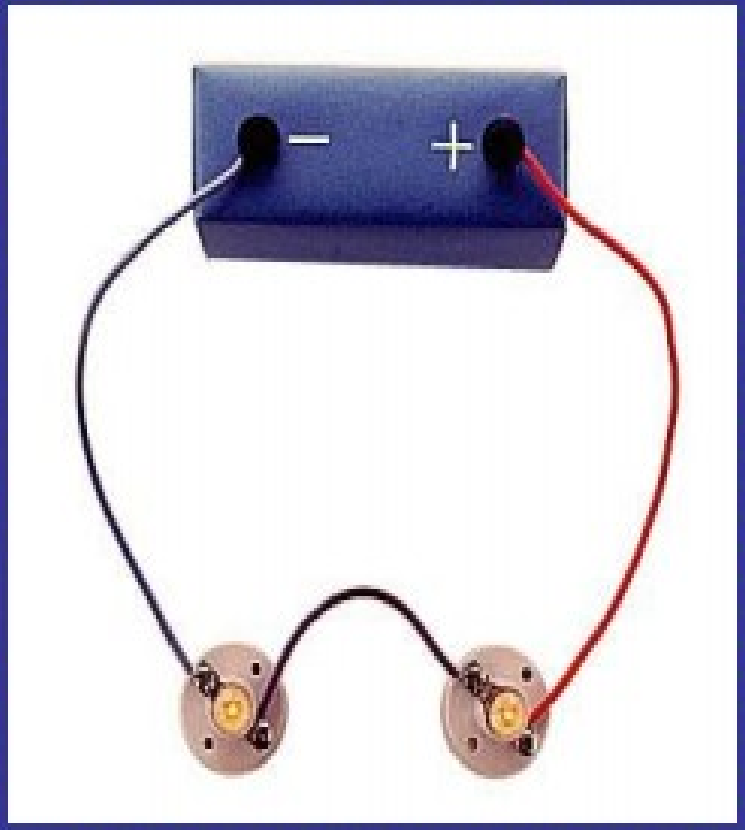
SERIES CIRCUITS

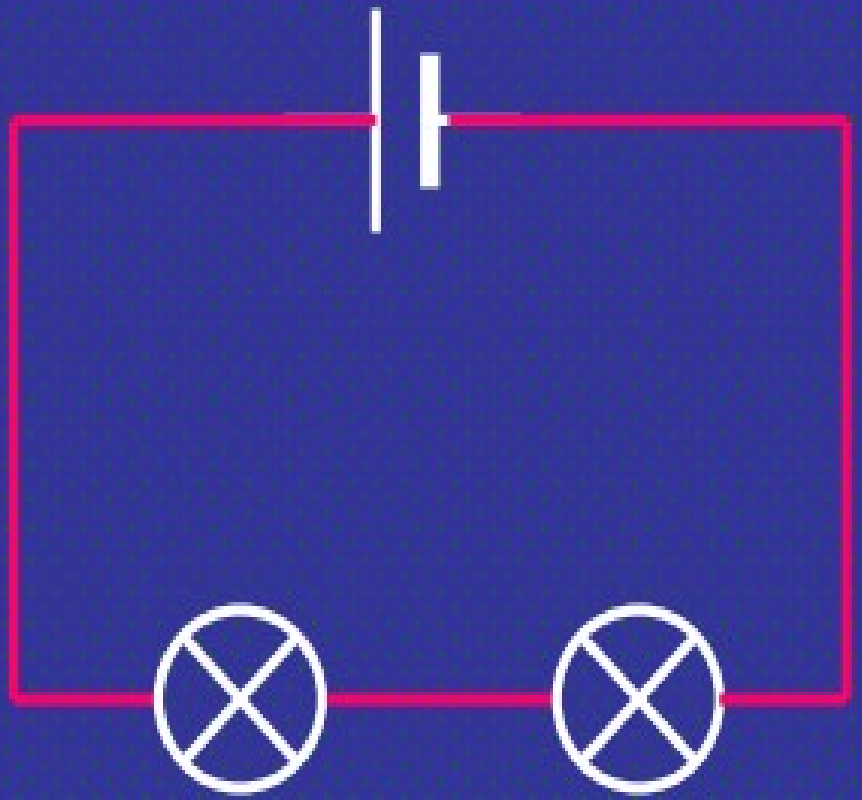


PARALLEL CIRCUITS



SERIES CIRCUITS

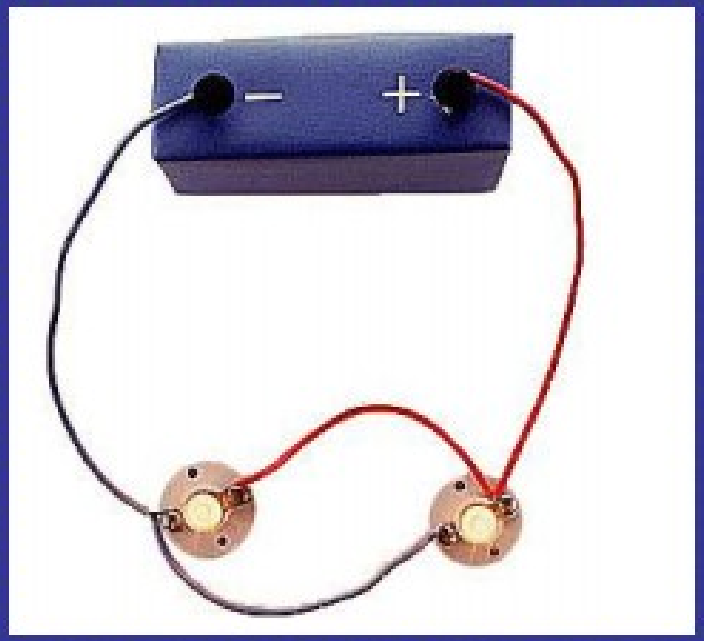


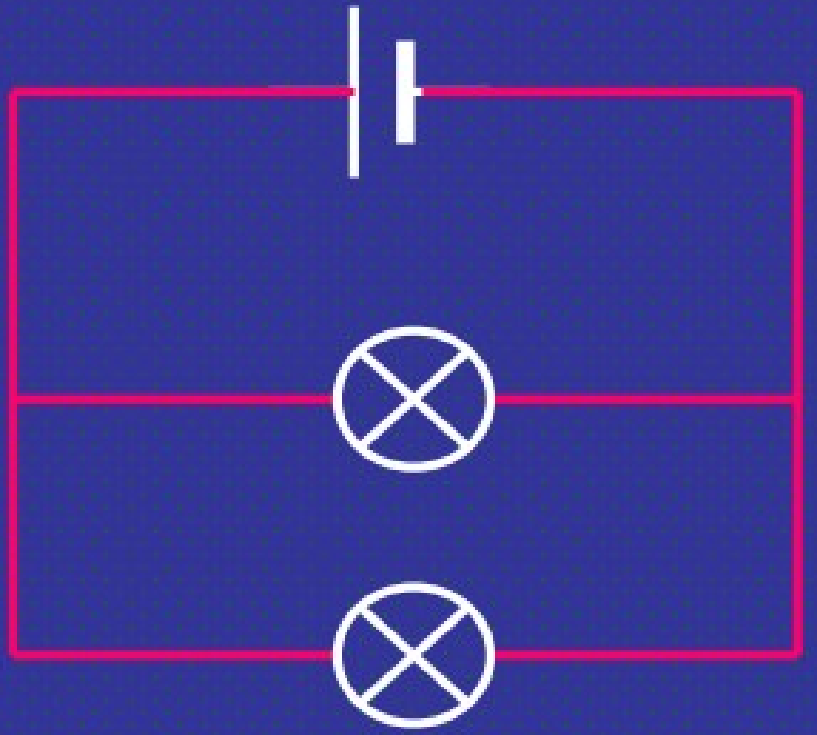


The components are connected end-to-end, one after the other.

They make a simple loop for the current to flow

PARALLEL CIRCUITS





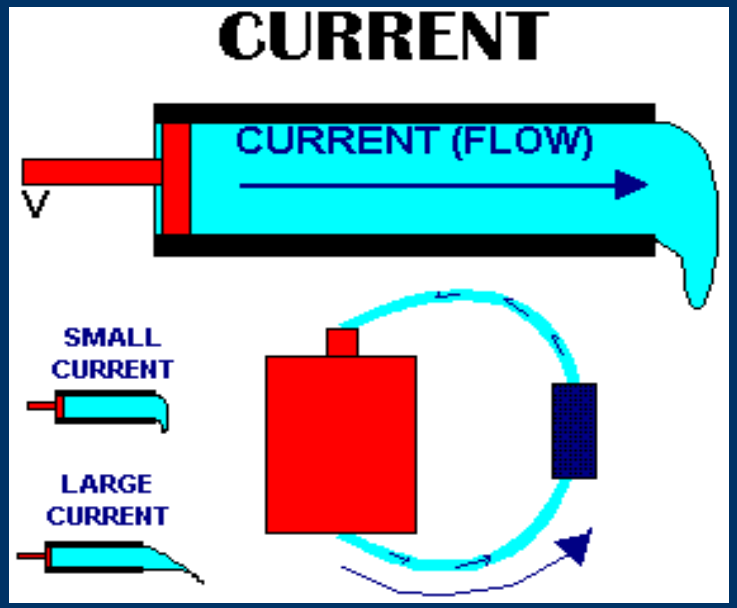
The components are connected side by side.

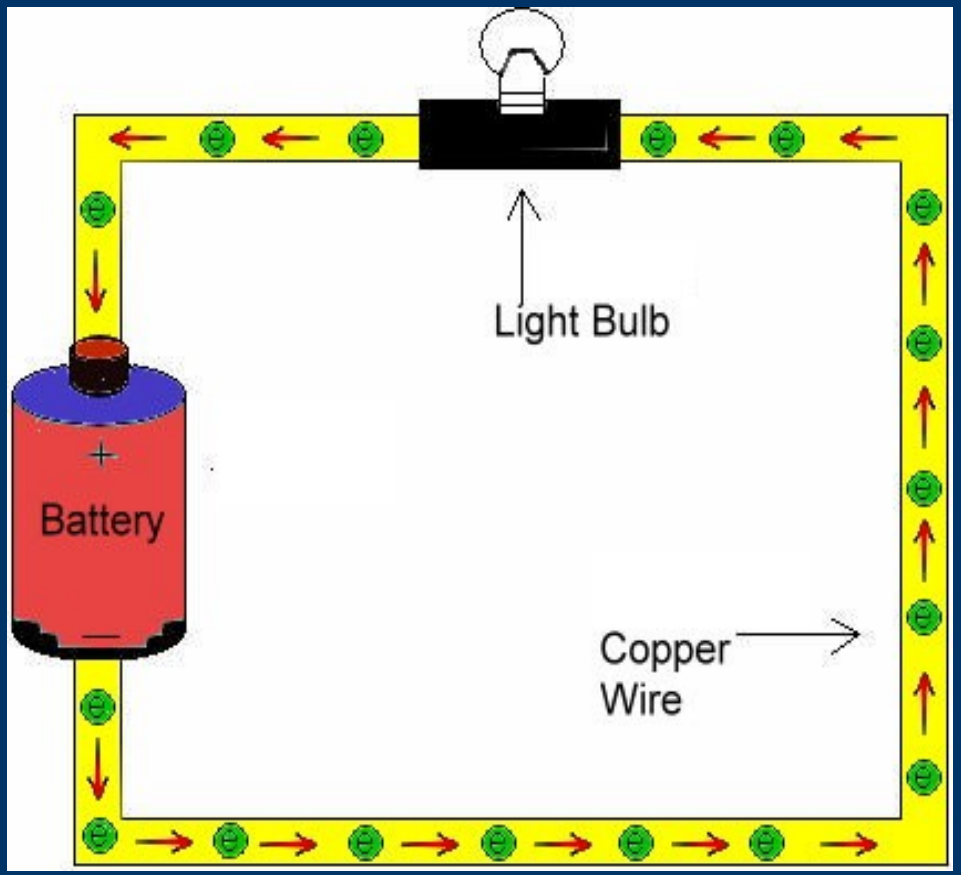
The current has a choice of routes.

If one bulb 'blows' there is still be a complete circuit to the other bulb so it stays alight.

ELECTRIC CURRENT

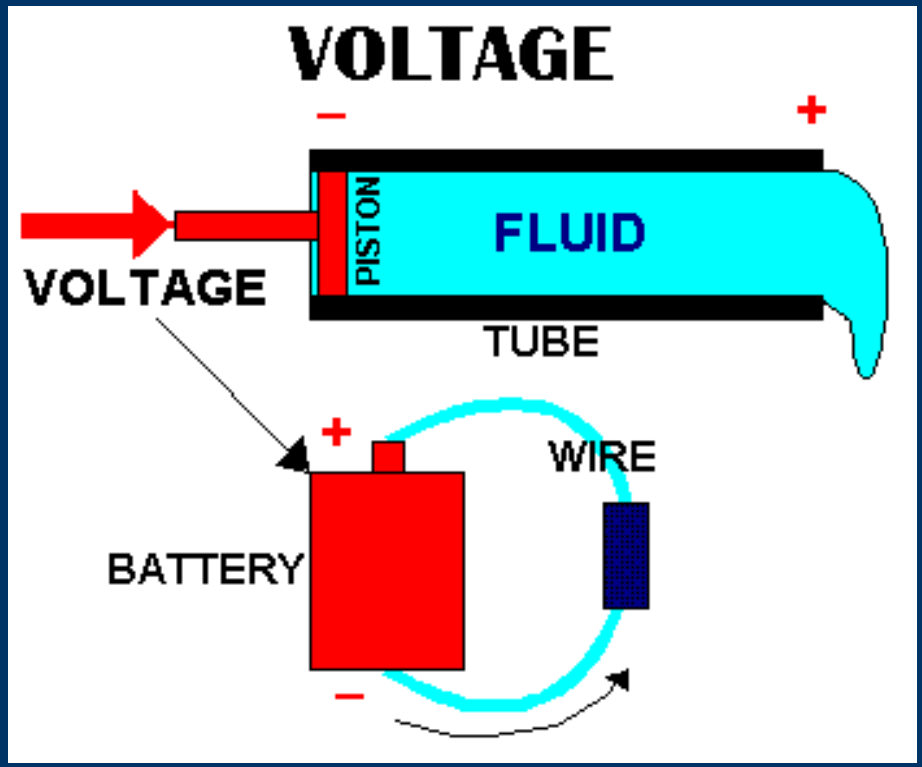
The Current is the rate of flow of electrons through a circuit. It is measured in amps.





VOLTAGE

The Voltage is the energy which pushes electrons around a circuit. It is measured in volts.



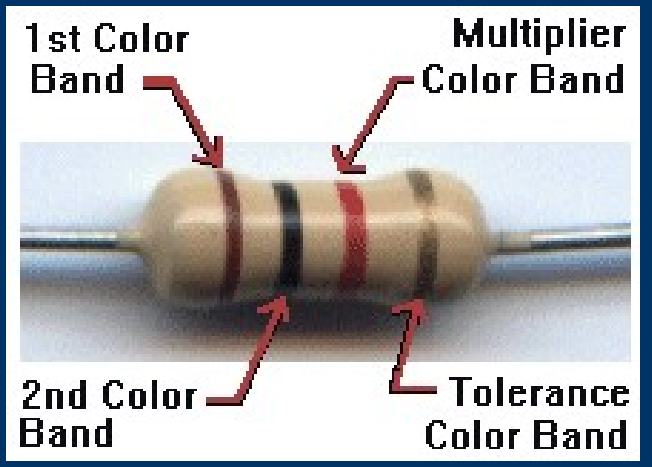
RESISTANCE

When electrons flow through a bulb or another conductor, the conductor does offer some obstruction to the current. This obstruction is called electrical resistance.

* Resistance increases when size decreases
* resistance decreases when length increases

Every material has an electrical resistance and this is the reason that the conductor gives off heat when the current passes through it.

Resistance is a measure of how much an object opposes the passage of electrons. The unit of electrical resistance is the ohm and it is represented by Ω



6.- Work in pairs. Put the wires in order from lower to higher:

OHM´S LAW

- George Simon Ohm (1789-1854) discovered the relationship between:

- VOLTAGE
- CURRENT
- RESISTANCE

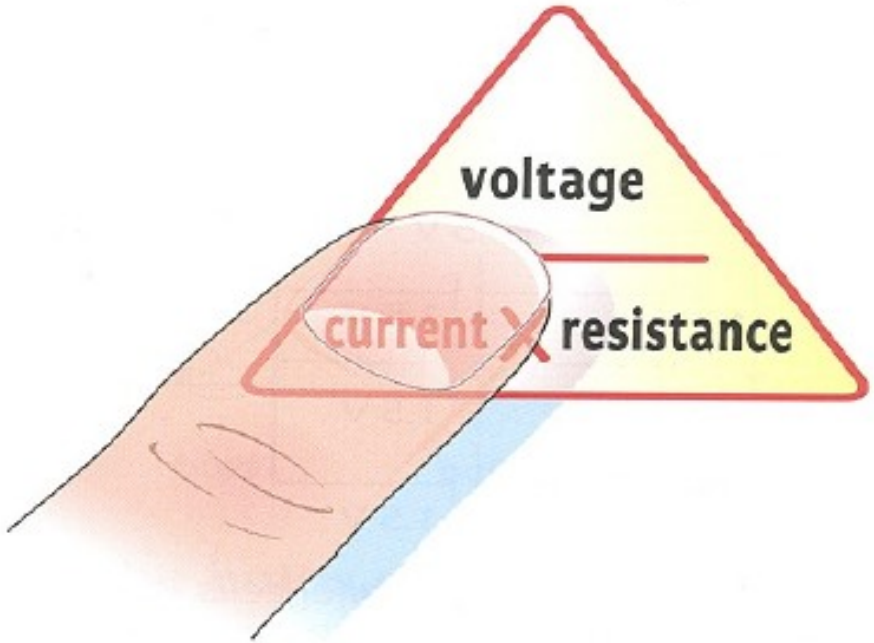
It was called

OHM's LAW

OHM's law formula:

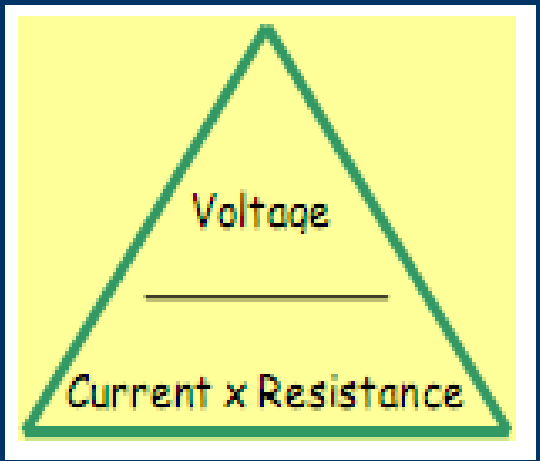
Voltage = Current x Resistance

A little help…

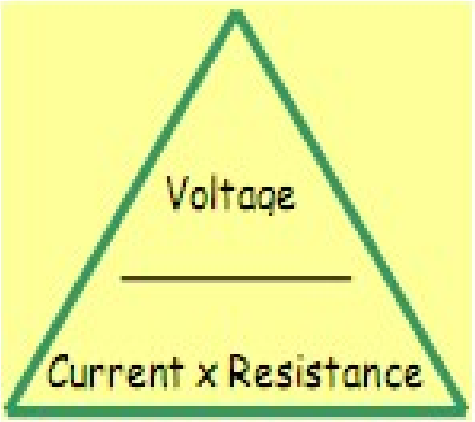


If I do not know.....

- the current I must_____ (multiply / divide) _____ (voltage /current /resistance) by _____ (voltage / current / resistance)
- the voltage I must _____ (multiply / divide) _____ (voltage /current /resistance) by _____ (voltage / current / resistance)
- the resistance I must _____ (multiply / divide) _____ (voltage /current /resistance) by _____ (voltage / current / resistance)



The circuit of a little torch  has 3 Ω of resistance. It has a 4,5 v battery. What is the current through the circuit?



Voltage =

Resistance =

Current =

Operations:

VOLTAGE IN SERIES AND PARALLEL CIRCUITS

vOLTAGES IN SERIES

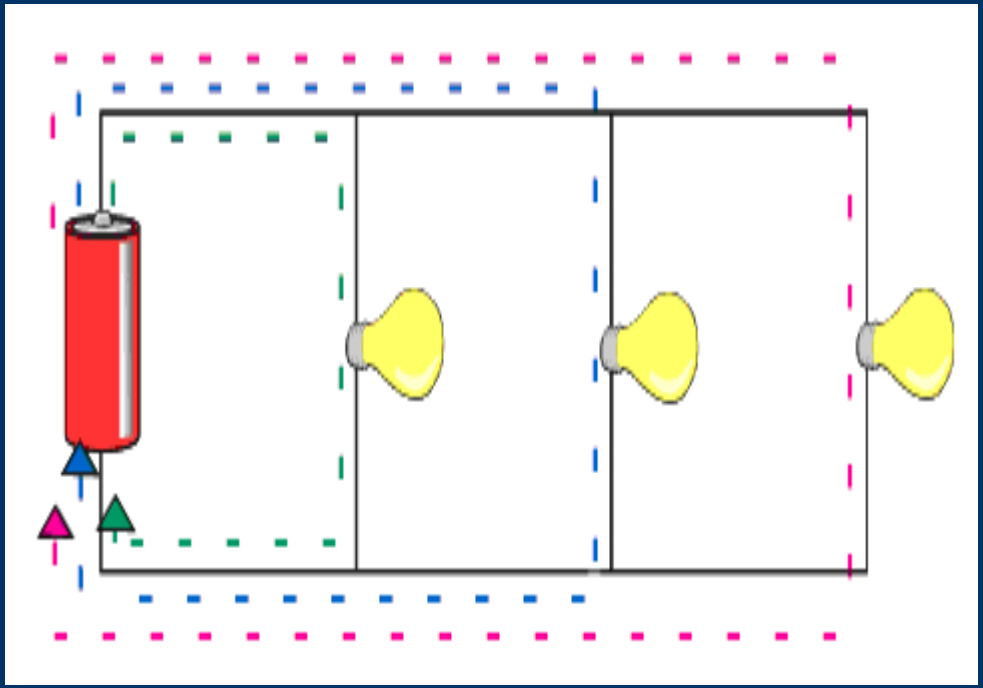
The potential difference across two (or more) consecutive parts of a series circuit is equal to the sum of the voltage of the different parts

$V = V1 + V2 + V3 + V4 + \ldots\ldots$

In other words

The energy lost by spider-man climbing a 50 floor building is equal to the sum of the energy lost if spider-man ran up the stairs from the first floor to the second plus the energy from the second to the third floor plus:.....

. . . . . .



VOLTAGES IN PARALLEL
The potential difference across each of a number of conductors connected in parallel with each other is the same.
V1 = V2 = V3 = V (Battery).
In the case, if the voltage of the battery is 10 Volts, every Bulb support 10 volts between its terminals.

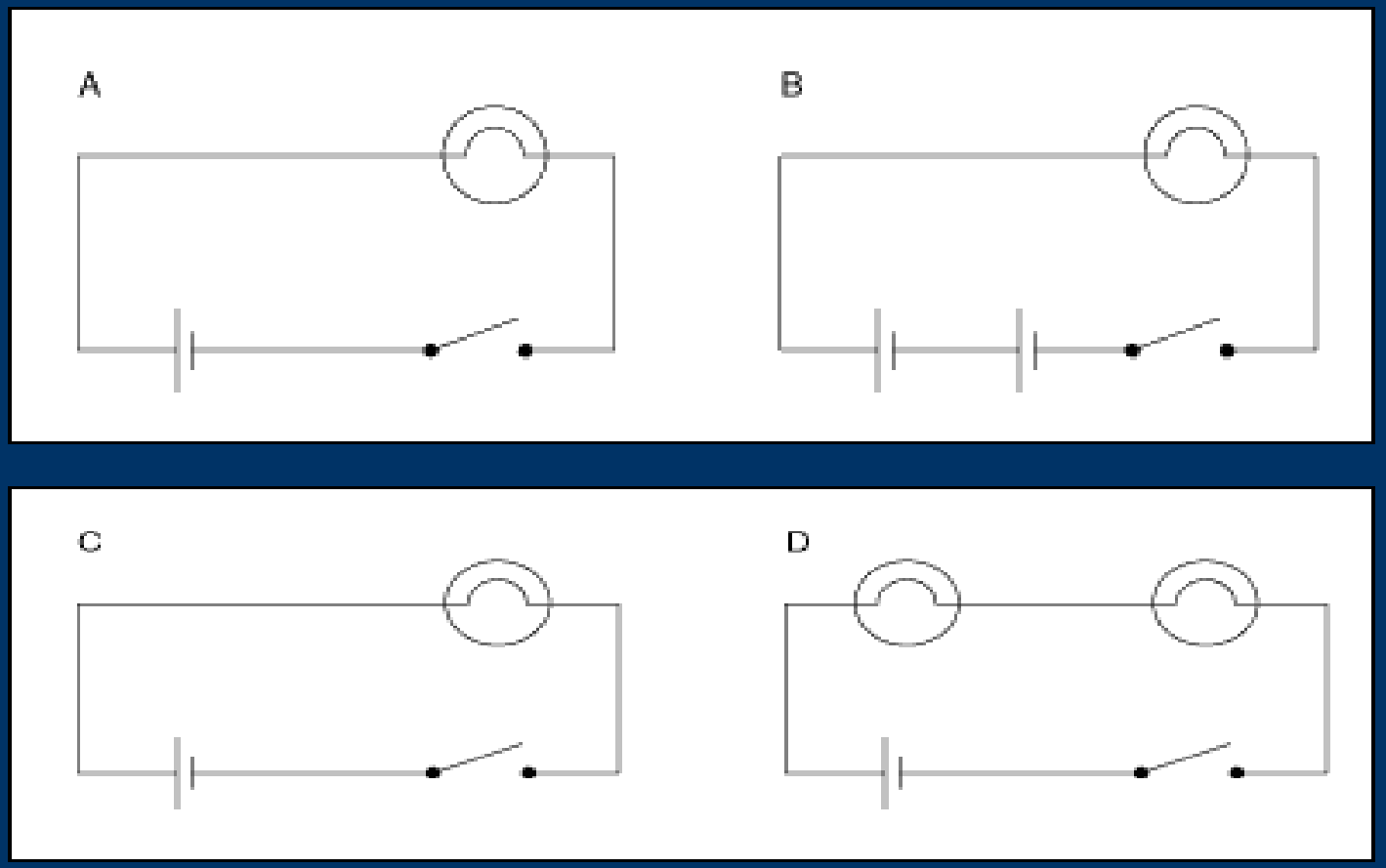
Remember: in Parallel~V1 = V2 = V3 = V (Battery) and in a series V (Battery) = V1 + V2 + V3..

EXERCICES

Examples and Exercises:

1º In the next exercises, batteries have equal values of 5 volts. Which circuit has the brighter globe, a or b? Why? What happens in c and d?

parallel 1
parallel 2



Alarm clock

Bread

Cd-cassette player

Toothbrush

Computer

Console

Mp3

DVD player

Television

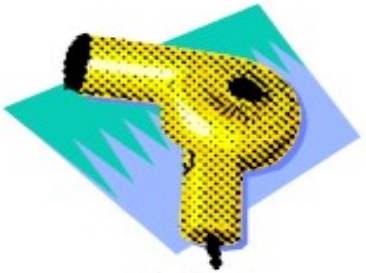
Heater

Washbasin

Mobile

Oven

CD player

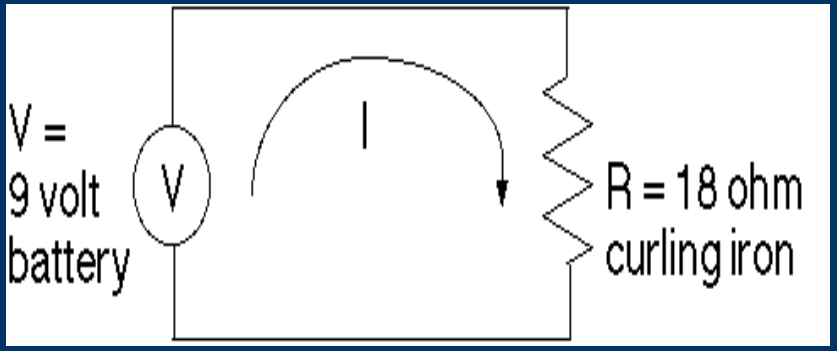


Hairdryer

Which of them need electricity to WORK?

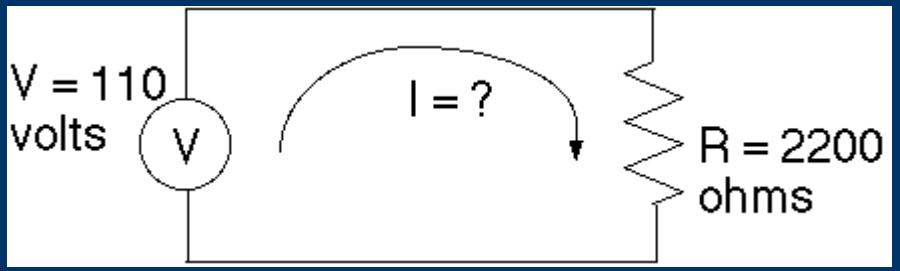
Example:example of ohm´s law

I = v/r A nine volt battery supplies power to a bulb with a resistance of 18 ohms. How much current is flowing through the bulb? Solution: Substitute in the values for



Exercises:

1º A 110 volt wall outlet supplies power to a TV set with a resistance of 2200 ohms. How much current is flowing through the TV?



2º A CD player with a resistance of 40 ohms has a current of 0.1 amps flowing through it. Calculate how many volts supply the CD player.

Choose your answer: a) 10.0 volts b) 0.0025 volts c) 400.0 volts and d) 4.0 volts

two resistor ins serie3º In this circuit, calculate:

a) the total resistance in the circuit
b) the total current flowing at point A
c) The current in R1 and R2
d) The voltage in R1 and R2

3º-two resistors in parallel4º In this circuit the resistors are in parallel: Calculate:

A) the total resistance in the circuit
B) the total current flowing at point B and the current at C and D
C) tension on R1 and R2

2º In the next circuits, the battery has a value of 6 volts. Calculate how may volts each lamp receives.