

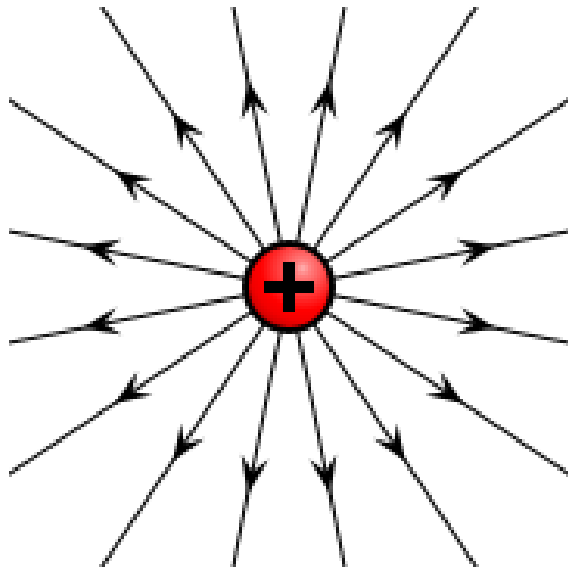


# **THE ELECTRIC CURRENT**

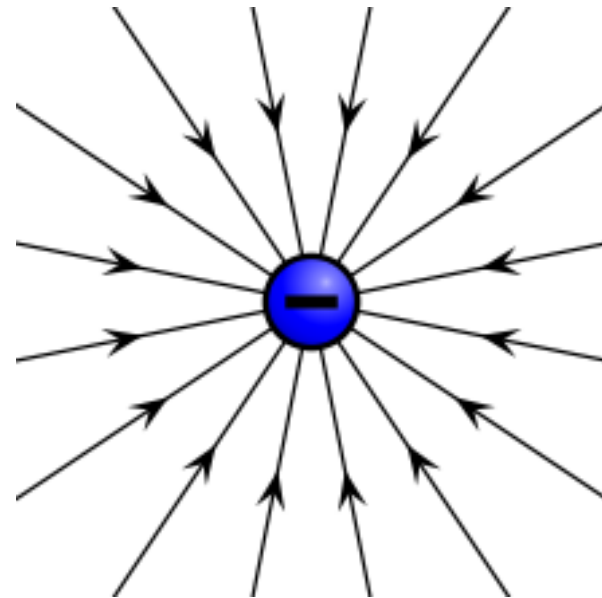
A presentation by Giulia Leo, Liceo Classico Socrate, IIF, 2018-2019

# Before we start...

*Charge = Carica*

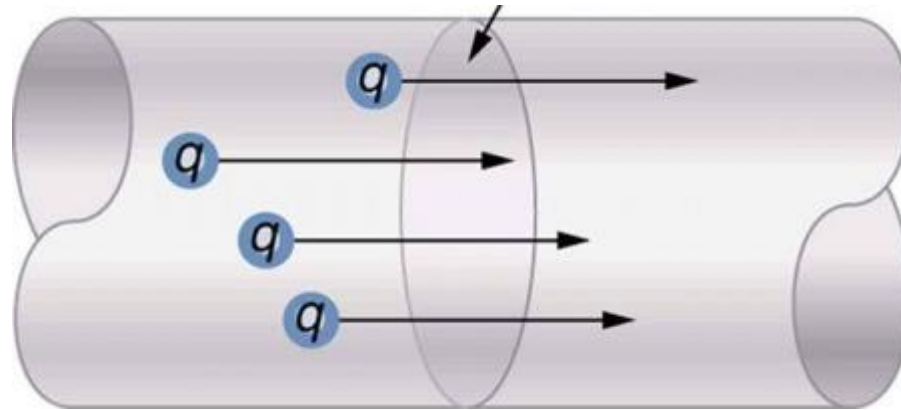


Positive charge

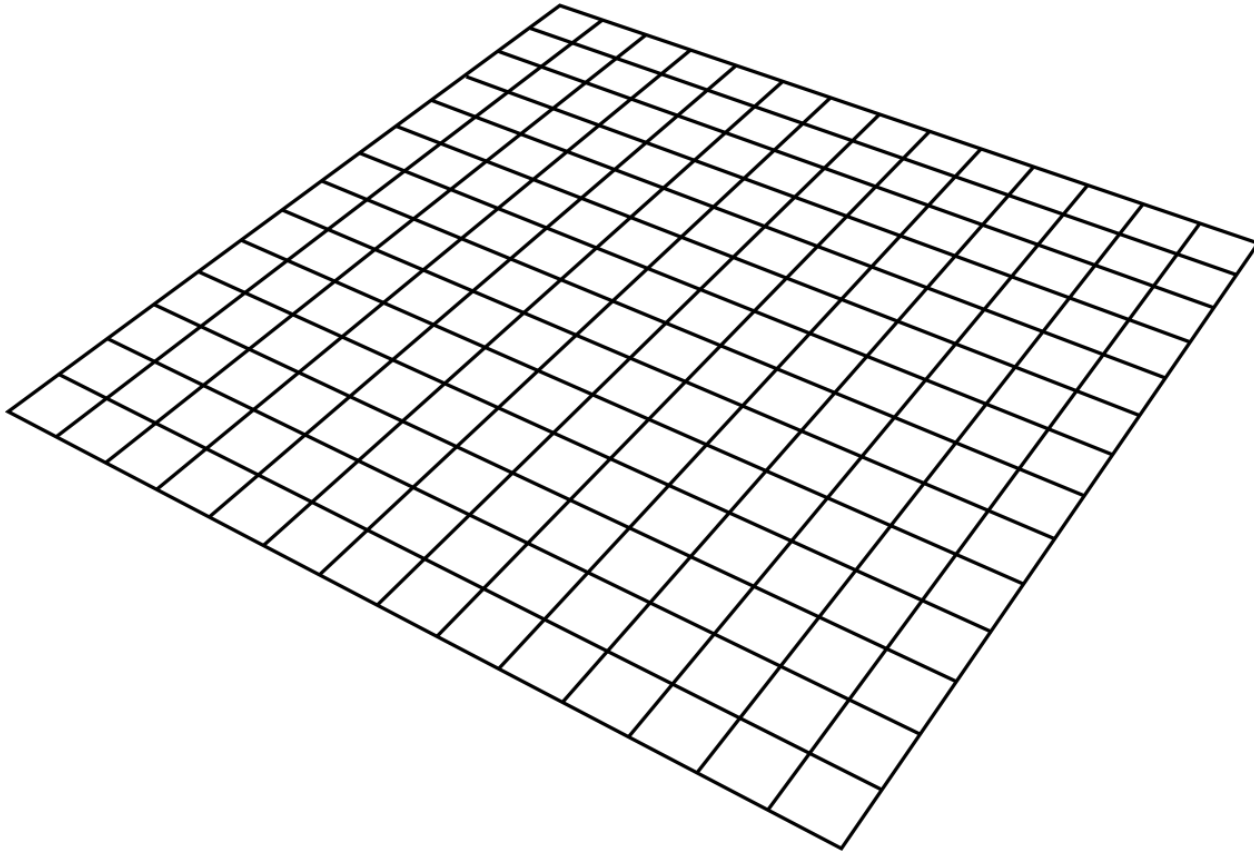


Negative charge

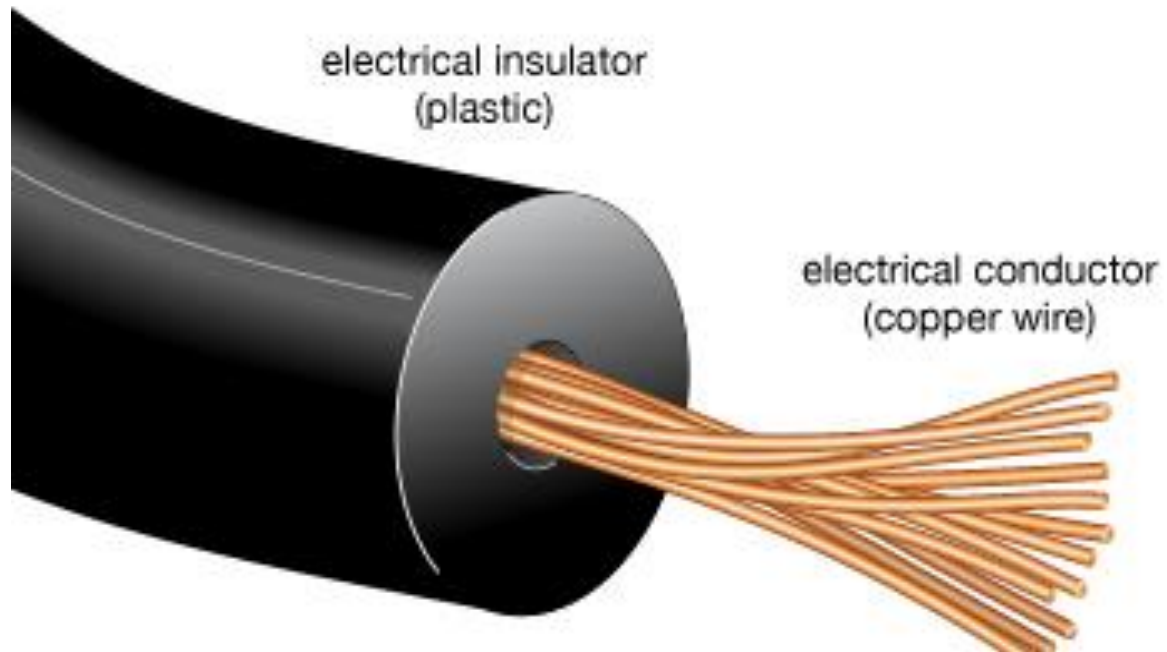
***Flow (of charges) = flusso/moto di cariche***




***Surface = Superficie***



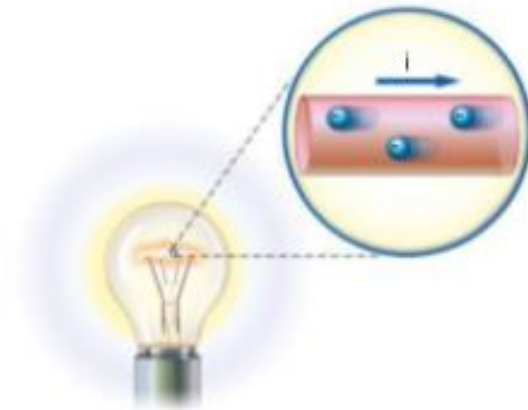
***Conductor = conduttore***



# Mathematical Signs

- +** plus, add, positive
- minus, subtract, less, take away, negative
- x \*** times, multiplied by
- ÷ /** divided by, divide 
- =** is equal to, equals

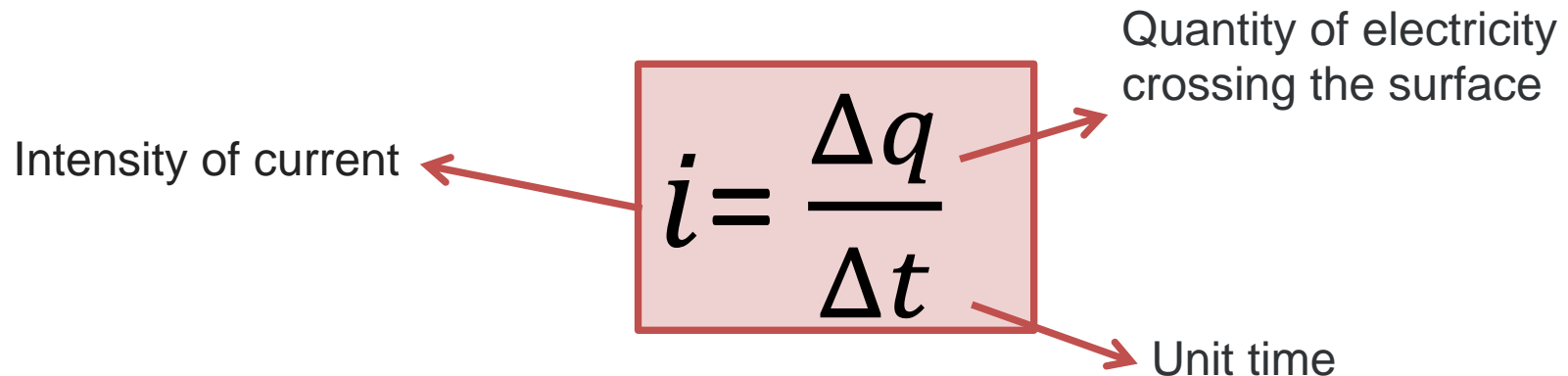
# Definition of Electric Current



Electric current can be defined as an ordered flow of positive or negative electric charges.

In order to quantify electric current, we use the **Intensity of current**.

Intensity of current is measured by the quantity of electricity crossing a specified area of equipotential surface per unit time.



The diagram shows the formula for the intensity of current,  $i = \frac{\Delta q}{\Delta t}$ , enclosed in a light red rectangular box. Three red arrows point from the formula to descriptive labels: one points from the left side of the box to the text "Intensity of current"; another points from the top-right part of the box to the text "Quantity of electricity crossing the surface"; and a third points from the bottom-right part of the box to the text "Unit time".

$$i = \frac{\Delta q}{\Delta t}$$

Intensity of current

Quantity of electricity crossing the surface

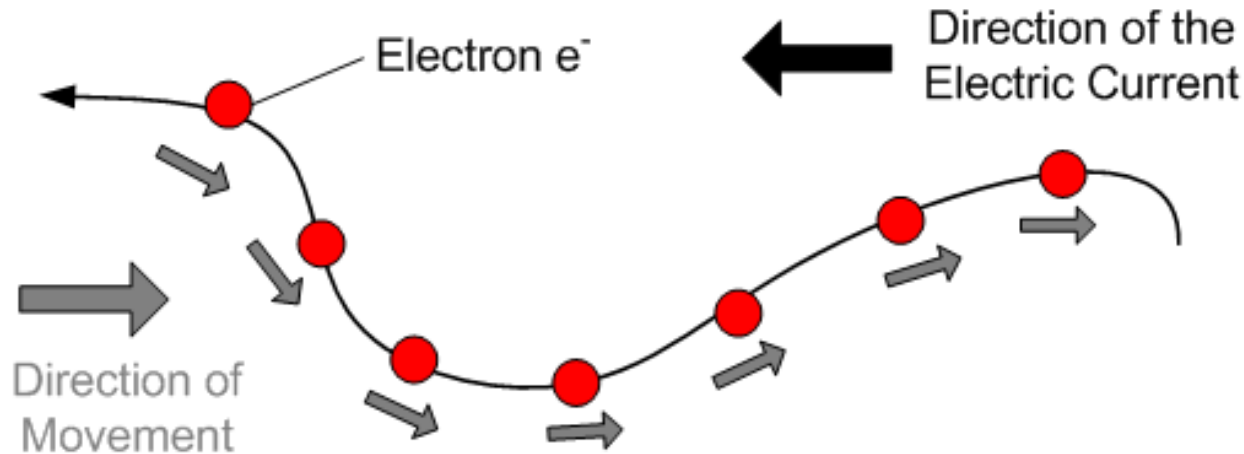
Unit time



The SI unit of electric current is the Ampere, which is the flow of electric charge across a surface at the rate of one coulomb per second.

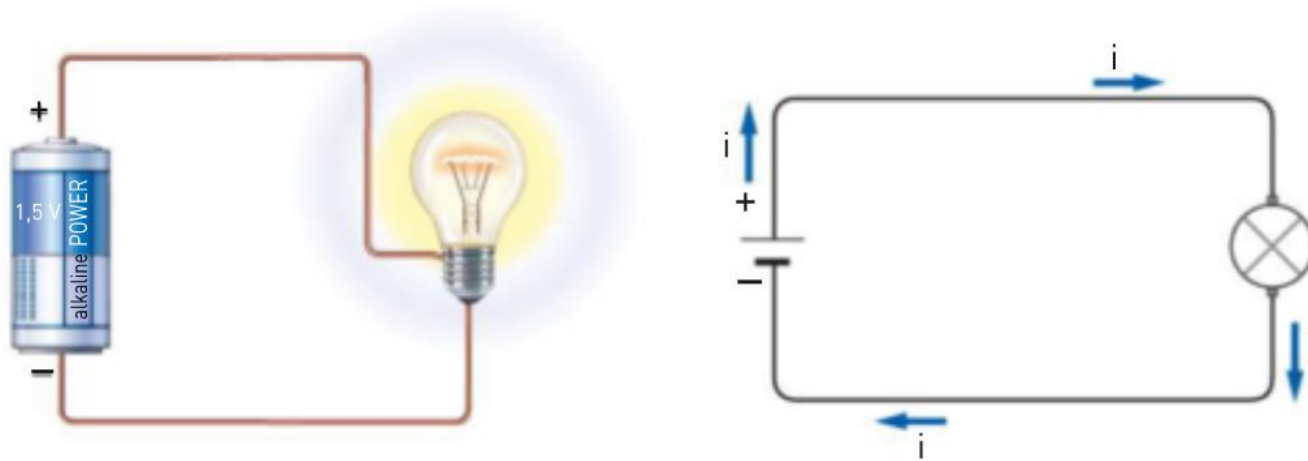
$$1 \text{ A} = 1 \text{ C/1s}$$

# The Direction of Electric Current



Benjamin Franklin defined the direction of electric current as opposite to the direction of motion of electrons.

# The Electrical Circuit

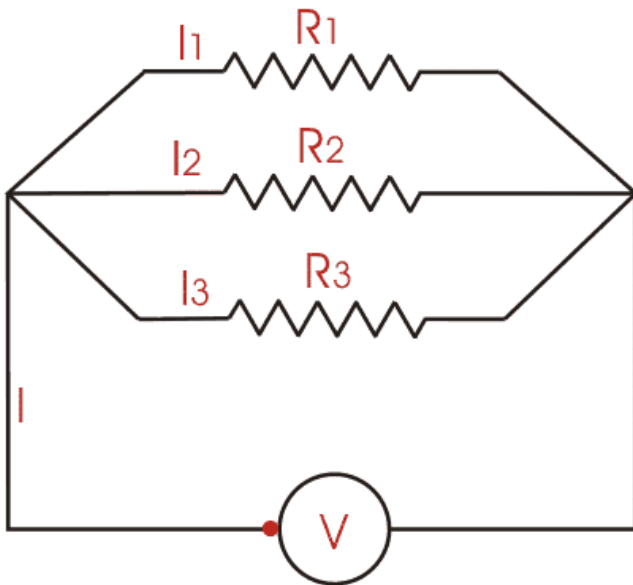


An electrical circuit is a path through which an electrical current flows.

It is composed by a chain of conductors connected to an energy source.

# Types of Circuits

## A) PARALLEL CIRCUIT

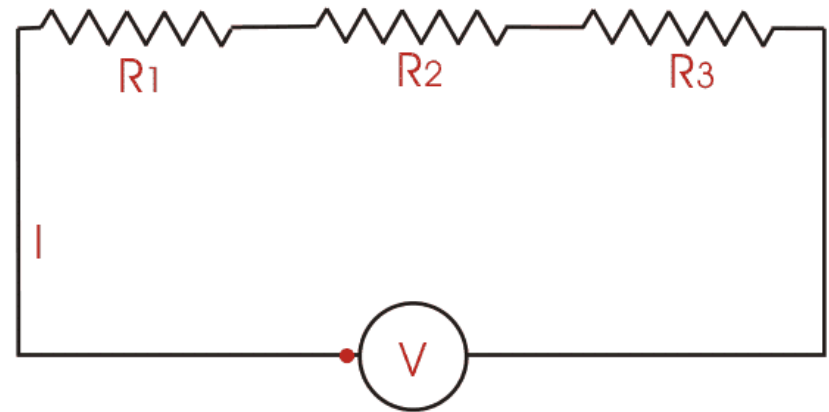


- A parallel circuit has two or more paths for current to flow through.
- Voltage is the same across each component of the parallel circuit.
- You can find total resistance in a Parallel circuit with the following formula:  
 **$1/R_t = 1/R_1 + 1/R_2 + 1/R_3 + \dots$**
- If one of the parallel paths is broken, current will continue to flow in all the other paths.

# Types of Circuits

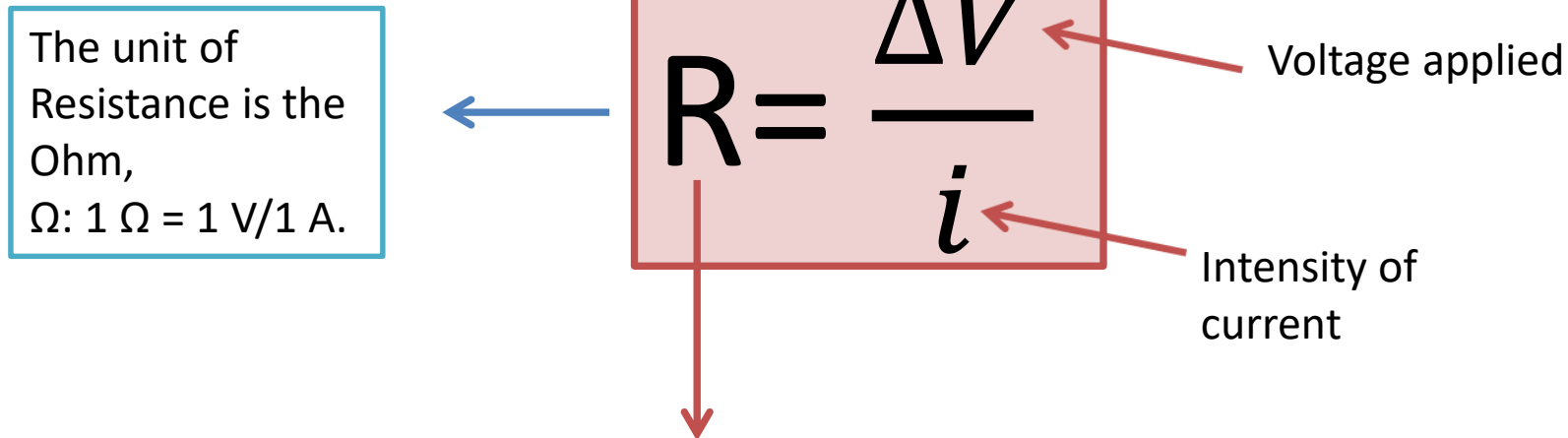
## *B) SERIES CIRCUIT*

- In a series circuit the current remains unchanged all along the circuit: all electric components receive the same current.
- The total resistance of a series circuit is equal to the sum of individual resistances.
- If the circuit is broken at any point, no current will flow.



# First Ohm's Law

In Ohmic conductors the intensity of current that flows through a device is directly proportional to the applied voltage.



R stands for **Resistance**, and it is the constant of proportionality between  $\Delta V$  and  $i$ .

# Second Ohm's Law

The Resistance in a conducting wire is directly proportional to its length and inversely proportional to its crosssectional area.

The diagram shows the equation  $R = \rho \frac{l}{A}$  enclosed in a light red box. A blue arrow points from the left side of the box to a separate box containing the text "The SI unit of Resistivity is the  $\Omega \times m$ ". Three red arrows point from the right side of the box to labels: "Resistance" points to the  $R$ , "Length of the wire" points to the  $l$ , and "Area of the wire" points to the  $A$ . A fourth red arrow points downwards from the  $\rho$  term.

The SI unit of Resistivity is the  $\Omega \times m$

Resistance

Length of the wire

Area of the wire

$\rho$  stands for **Resistivity**, and it's the constant of direct proportionality between  $R$  and  $l$  and of inverse proportionality between  $R$  and  $A$ .

# Resistance VS Resistivity

- **Resistance** depends on the geometry, section and length of the conductor.

- **Resistivity** can depend on the material of the conductor or on variations of temperature.

- **Resistance** is a characteristic of the conductor.

- **Resistivity** is a characteristic of the material.



# Superconductivity

Superconductivity is the property of some materials to conduct electricity without resistance below a certain temperature, whose value changes depending on the material.

