Electric Current | Electric current Direction and Current Through a Metallic Conductor

Electric current is the flow of charged particles such as electrons and ions moving through a conductor or space. It is measured as the net flow of charge to the surface or control volume.

The presence of current can be detected by the effects of current.

Electric Charges ΔQ passing through any cross-section of a conductor in time Δt is called Electric Current"

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

Unit of electric current

The SI unit of current is **Ampere**

The current will be 1Ampere if 1-coulomb charge flows through any cross-section of a conductor in 1 second".

What are Charge Carriers?

Electric current is due to the flow of charged particles. These charged particles are called “Charge Carriers

There are many charge carriers

METALS

In metals, charge carriers are negatively charged for example electron

ELECTROLYTES

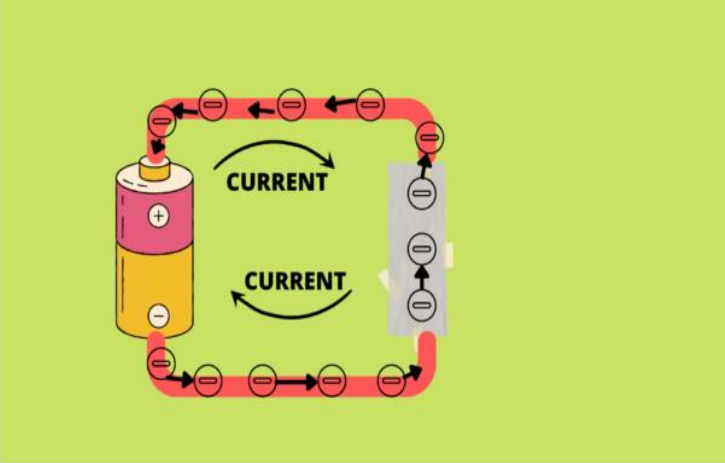
In electrolytes, charge carriers are positive and negative ions for example Cu^{++} and SO_4^{-}

GASES

In gases, charge carriers are electrons and ions.

Electric current direction:

The current passes from a point at the higher potential to a point at lower if it shows the movement of positive charges. This is called conventional current.



Early scientists regarded an electric current as a flow of positive charges from the positive to the negative terminal of a battery through an external circuit.

Later on, it was found that a current in metallic conductors is actually due to the flow of negative charge carriers called electrons moving in the opposite direction from the negative to the positive terminal of the battery.

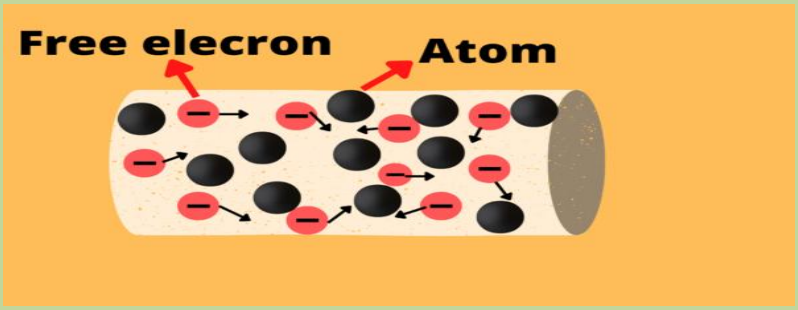
But it is the convention to take the direction of current as the direction in which positive charges flow this current is called "***Conventional Current***".

The reason is that it has been found experimentally that positive charges moving in one direction are equivalent in all external effects to the negative charges moving in the opposite direction.

As the current is measured by its external effects, the current due to the motion of negative charges, after reversing its direction of flow, can be considered as the current flowing due to the positive charges.

Current through a metallic conductor

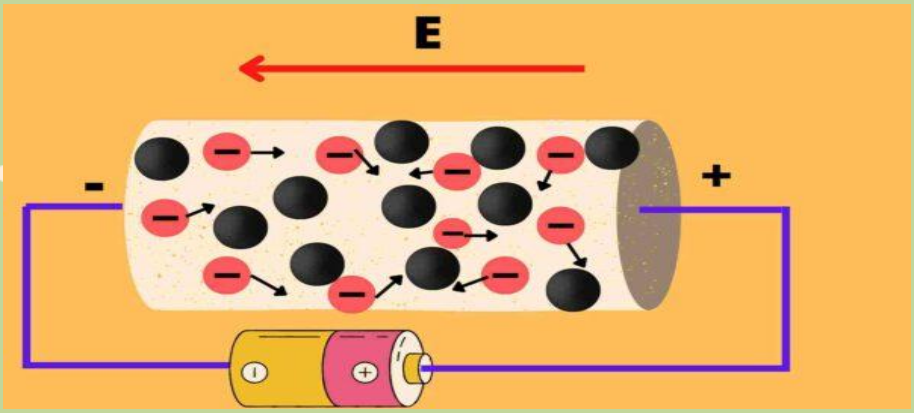
In metals, the valence electrons are not attached to a particular atom but they are free to move inside the metal these electrons are called "**Free Electrons**".



They move randomly inside the metal like gas molecules. Their speed depends upon the temperature

Consider a piece of wire. The number of free electrons moving toward the left is equal to the number of free electrons moving toward the right.

So the net current through the wire is zero. If the ends of the wire are connected to a battery, an electric field will be set up at every point within the wire. Now the free electrons will experience a force in the direction of -E.



The force experienced by the free electrons does not accelerate due to the collisions with the atoms.

What is drift velocity?

"Due to the collisions of the electrons with the atoms of the conductor, the electrons acquire a uniform velocity called the Drift Velocity."

The value of drift velocity is approximately 10^{-3}ms.

Now a steady current is established in the wire when a constant potential difference is applied across it.