Phy "Electric Current" Summary

Saturday, January 14, 2023 6:09 PM

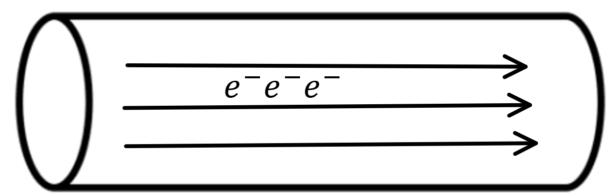
→ The electric current in a metal is due to ordered displacement of free electrons.

1. **<u>Definition</u>**:
   The electric current in a conductor is the amount of charges that cross a given section of the conductor in a unit of time.

   $\mathrm{I} = \mathrm{Q} \times \mathrm{t}$

   <u>Where:</u>

✓ I: electric current in amperes (A)
✓ Q: quantity of charge flowing in Coulombs (C)
✓ t: duration of flow in seconds (sec)



<u>REMARK!!!</u>

$\text{mA} \xrightarrow{\times 10^{-3}} \text{A}$

$\mu\text{A} \xrightarrow{\times 10^{-6}} \text{A}$

→ **<u>According to the definition:</u>**

$I = \dfrac{Q}{t}$

But, $Q = N \times e$

$\Rightarrow I = \dfrac{N \times e}{t}$

<u>REMARK!!!</u>

$\rightarrow \dfrac{\mathrm{I}}{\mathrm{e}} = \dfrac{\mathrm{N}}{\mathrm{t}}$: used to determine the number of charges flowing in a unit of time

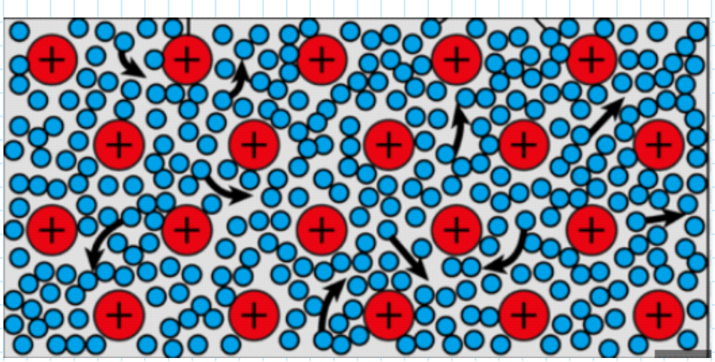
$\rightarrow I = \dfrac{Q}{t}$

$\Rightarrow Q(C\,) = I(A) \times t(sec)$

Q(A-hr) $\xrightarrow{\text{x3600}}$ Q(C)

<u>Another unit used (commercial unit):</u>

$Q(A - hr\,) = I(A) \times t(hr)$



: Conductors are characterized by their $\boxed{\text{free electrons}}$ on their surface

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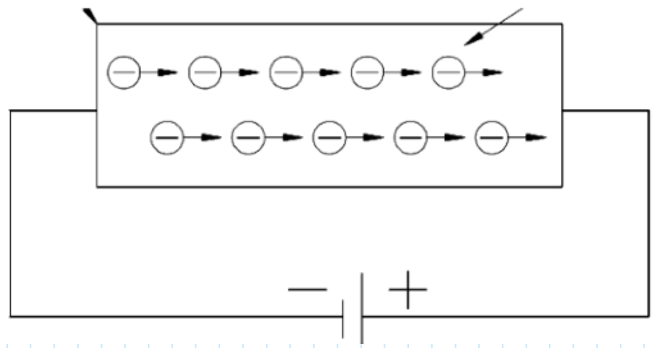
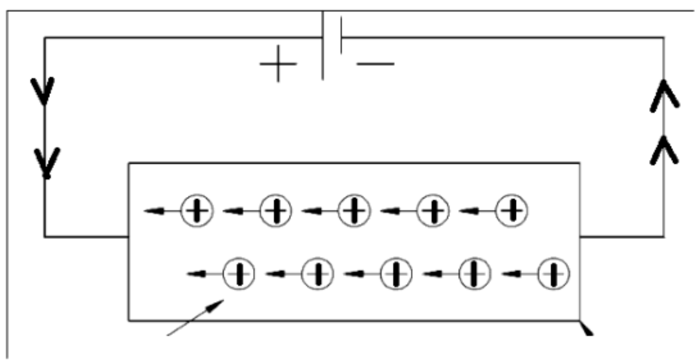
they are usually found in random motion.

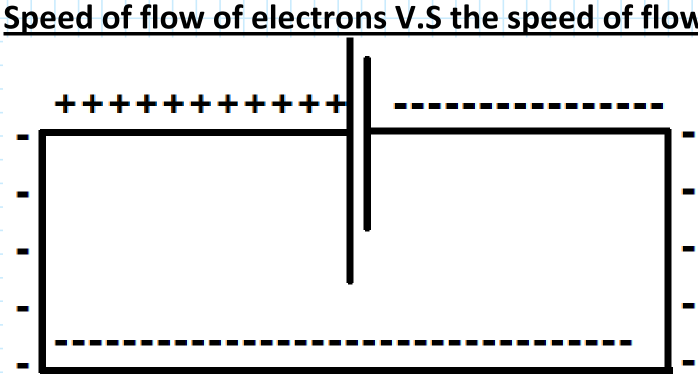


: When a potential difference is applied across the terminals of the conductor, an ordered displacement of electrons is obtained (this will lead to the production of electric current).

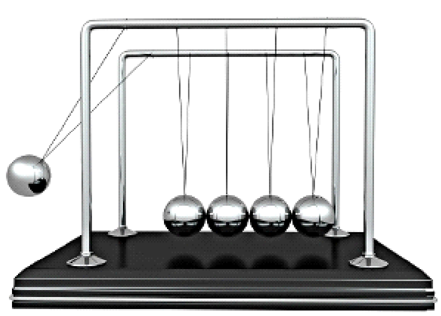


: In an electrolyte solution, the direction of current is the same that of the +ve ions in the solution.

2. **<u>Speed of flow of electrons V.S the speed of flow of current:</u>**



The speed of electrons is different than the speed of flow of current, (that of electrons is few mm/sec, while that of current is almost equal to the speed of light C= 3×10^3)



: By analogy, the particles in Newton's grade move at a very low speed (similar to the speed of transfer of electrons = 1, while the speed of transfer of energy is very high ,similar to that of electric current).

1. **Measuring the Electric Current:**
   The current is measured using an ammeter that must be in series (since it has a negligible resistance)

→ **For an Analog Meter:**

$$I = \frac{S \times d}{D}$$

Where:

- ✓ Dial: total number of divisions
- ✓ d: deviation of the needle
- ✓ S=R: max voltage that can be measured
  (S= Scale / R= Range)
- ✓ I: current in amperes (A)

Remark!!!

To measure very small currents, we use a sensitive ammeter (galvanometer).

4. **Junction's Law:**

The sum of currents reaching a junction is equal to the sum of currents leaving the junction.

$$\sum I_{entering} = \sum I_{leaving}$$