

ELECTRICITY

Electric Charge

ELECTRIC CHARGE:

When we run our shoe across a carpet and reach for a metal doorknob, we can be zapped by an ongoing spark of electricity. The answers to this lie in the branch of Physics called Electrostatics. The word electricity comes from the Greek word electron, which means “amber.” Amber is petrified tree resin and it was well known to the ancients that if we rub an amber rod with a piece of cloth, the amber attracts small pieces of dry leaves or paper. A piece of hard rubber, a glass rod or a plastic comb rubbed with cloth also display this “amber effect” or static electricity or frictional electricity as we call it today.

Experiments show that there are exactly two kinds of electric charges:

- (i) Negative charge
- (ii) Positive charge

This also shows that unlike charges attract each other while like charges repel each other.

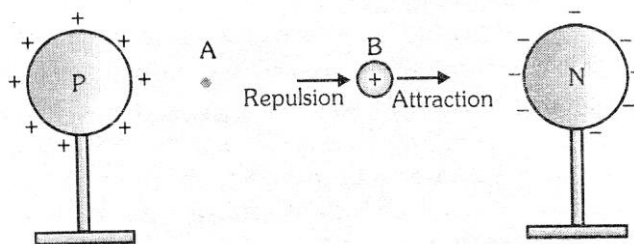
The S.I. unit of electric charge is coulomb. It is denoted by symbol **C**

FLOW OF CHARGE:

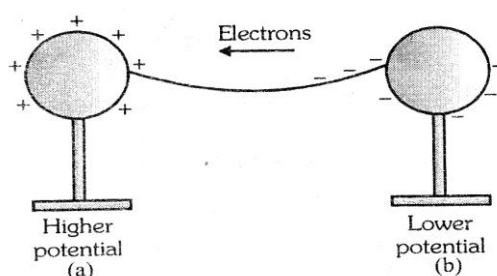
Consider two identical metallic spheres P and N, carrying equal amounts of positive and negative charges respectively. A positive charge is to be taken from B to A. It is attracted by the negatively charged sphere N and repelled by the positively charged sphere P. So, to move the charge towards A, one has to apply a force on it towards the left. Thus, the work done is positive. Hence, the potential difference $V_A - V_B$ is positive.

This means $V_A > V_B$.

As one moves towards P, the work done increases; so, the potential increases; And on moving towards N, the potential decreases. So, the potential of P is higher than of N. In general, the potential of a positively charged body is taken as higher than of a negatively charged body.



What happens when a free-to-move charge is placed between the spheres? A positive charge will move towards the negatively charged sphere. And a negative charge will move towards the positively charged sphere. That is, a free positive charge moves towards lower potential. And a free negative charge moves towards higher potential. If the two spheres are connected by a metal wire, electrons from the negatively charged sphere (at a lower potential) will flow to the positively charged sphere (at a higher potential). Eventually, the flow of electrons causes the charges on the spheres to become balanced. When that happens, the spheres no longer carry a net charge, and therefore, have equal potential. So, the flow of electrons stops. So, we can say that **a potential difference causes charges to flow**.



A CELL PROVIDES A CONSTANT POTENTIAL DIFFERENCE

The potential difference provided by things like charged spheres reduces to zero quickly once charges start to flow. So, we have to use cells to provide constant potential difference for a long time. Cells have chemicals inside. Reactions in the cell cause positive and negative charge to gather separately. This creates a potential difference between the terminals of the cell. The terminal at a higher potential is called the positive terminal and the one at a lower potential is called the negative terminal.

The cells that we commonly use are called dry cells (Figure). In a common dry cell, the small metallic cap at one end is the positive terminal, while the flat metallic plate at the other end is the negative terminal. It provides a potential difference of 1.5 V. A cell is represented by the symbol shown in fig (b). The larger line represents the positive terminal, while the shorter line represents the negative terminal.

A COMBINATION OF CELLS IS CALLED A BATTERY

Quite often, multiple cells are combined to get a potential difference that is higher than that of a single cell. For example, we connect two 1.5V cells to get a potential difference of 3V (Figure (c)) This is shown using symbols

