ELECTRIC CHARGE AND FIELD

BASIC PROPERTIES OF ELECTRIC CHARGE

PROPERTIES OF CHARGE

(i) Charge is a scalar quantity:

It adds algebraically and represents excess, or deficiency of electrons.

(ii) Charge is of two types:

Positive charge and Negative charge

Charging a body implies transfer of charge (electrons) from one body to another. Positively charged body means loss of electrons, i.e., deficiency of electrons. Negatively charged body means excess of electrons. This also shows that **mass of a negatively charged body > mass of a positively charged identical body.**

(iii) Charge is conserved:

In an isolated system, total charge (sum of positive and negative) remains constant whatever change takes place in that system.

(iv) Charge is quantized:

Charge on anybody always exists in integral multiples of a fundamental unit of electric charge. This unit is equal to the magnitude of charge on electron ($1e = 1.6 \times 10^{-19}$ coulomb). So charge on anybody $Q = \pm ne$, where n is an integer and e is the charge of the electron.

Millikan's oil drop experiment proved the quantization of charge or atomicity of charge

Note: Recently, the existence of particles of charge $\pm\frac{1}{3}e$ and $\pm\frac{2}{3}e$ has been postulated. These Particles are called quarks but still this is not considered as the quantum of charge because these are unstable (They have very short span of life).

(v) Like point charges repel each other while unlike point charges attract each other.

(vi) Charge is always associated with mass, i.e., charge cannot exist without mass though mass can exist without charge. The particle such as photon or neutrino which have no (rest) mass can never have a charge.

(vii) Charge is relativistic ally invariant:

This means that charge is independent of frame of reference, i.e., charge on a body does not change whatever be its speed. This property is worth mentioning as in contrast to charge, the mass of a body depends on its speed and increases with increase in speed.

(viii) A charge at rest produces only electric field around itself; a charge having uniform motion produces electric as well as magnetic field around itself while a charge having accelerated motion emits electromagnetic radiation.