Electricity

lecture -1-

Electric charge

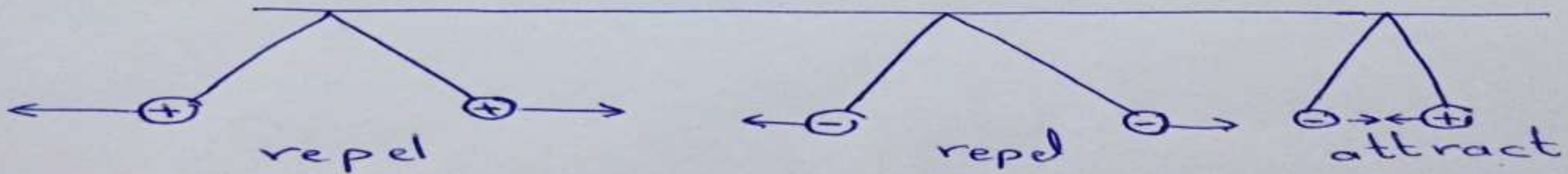
[illegible]

① g^+ Glass rod by robbing of with sille

② P^- plastic rod can by charged by robbing it an acoat sleeve

g^+ repels g^+ but attract p^-

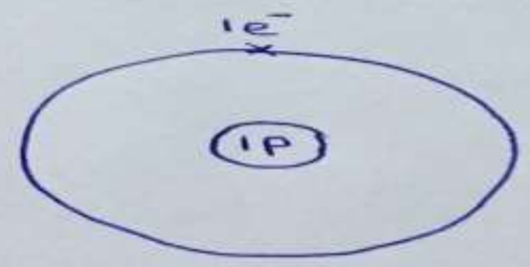
P^- repels p^- but attract g^+



Charge and Matter بارگەو ماددە

Matter consist of moleculus and atoms

Atom → electrons
Atom → protons } in Nucleus
Atom → Neutron } in Nucleus



i.e

H- Atom

Constants

(Me) mass of electron = 9.11×10^{-31} Kgm

(Mp) mass of proton = 1.67×10^{-27} Kgm

(Mn) mass of Neutron = 1.67×10^{-27} Kgm.

(q_e) charge of electron = -1.6×10^{-19} coul.

(q_p) charge of proton = $+1.6 \times 10^{-19}$ coul.

(q_n) charge of neutron = Zero = 0 (No charge)

Formation of electrostatic charge

1- Rubbing

2- Contact

3- Induction

Conductors and Isulator

① Conductors : Metals are considered agood conduct for electricity because of their crystal structure which have free electron e.g capper, Aluminum, silver.

② Insulator : Electric charge are not free to move throught the material no free electrons are exit e.g rubber, plastic, glass

③ Semi Conductor : Is intermedate between conductors and Insulator inits ability to conduct electricity e.g Germanum, Selicon.

Colombs law (F_e)

The electro static force between two charged bodies is direct proportial to the product of their indiviual charge and universely proportional to the squar of their separation

$$F \propto \frac{q_1 q_2}{r^2} \quad , \quad F \propto q_1 q_2 \quad - \quad F \propto \frac{1}{r^2}$$

$$\boxed{F = K \frac{q_1 q_2}{r^2}}$$ colombs law

K = proportional constant

$$K = 9 \times 10^{9} \frac{Nt \cdot m^2}{coul^2}$$

$$K = \frac{1}{4\pi\epsilon_0}$$

$$K = \frac{1}{4 \times 3.14 \times 8.85 \times 10^{-12}}$$

$$K = 9 \times 10^{9} \frac{Nt.m^2}{coul^2}$$

$\epsilon_0 = 8.85 \times 10^{-12}$ [permitivity constant of free space]

① $F \propto q_1 q_2$: The force is propotional to the product of charges q_1, and q_2 on the particles.

② The force universely proportional to the squar of separation r^2 between two charged particles

$$F \propto \frac{1}{r^2}$$

تنبيه ③ The force (F) is attractive if the charges are oppositive sign (−) and repulsive if the charges have the same sign (+).

Units

① esu q = state coulombs

r = cm , F = dyne , $k = 1$

② MKS q = coulomb , F = Newtons

$k \neq 1$, $k = 9 \times 10^{9} \frac{Nt \cdot m^2}{coul^2}$

Example (1) :

Calculat the value of two charges if repel one another ($q_1 = q_2 = q = ?$) with force $F = 0.1\ Nt$ when situated $r = 50\ cm$ apart in avacuum.

Solution : $F = K \frac{q_1 q_2}{r^2}$

since $q_1 = q_2 \Longrightarrow q_1 q_2 = q^2$

$$F = K \frac{q_1 q_2}{r^2}$$

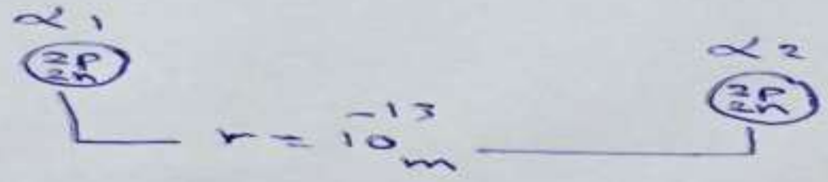
$$0.1 = 9 \times 10^9 \frac{q^2}{(50 \times 10^{-2})^2}$$

$$9 \times 10^9 q^2 = 0.1 \times (50 \times 10^{-2})^2$$

$$q = \sqrt{\frac{0.1 \times (50 \times 10^{-2})^2}{9 \times 10^9}} = 1.7 \times 10^{-6}\ coul.$$

Example (2) Two α-particle (α_1, α_2) are placed at separational of ($r = 10^{-13}$ m). What is the force acting between them ($F = ?$) knowing that α-particle contains 2 neutron + 2 protons if $q_p = 1.6 \times 10^{-19}$ coul. q_n = zero

$$K = 9 \times 10^{9} \frac{Nt \cdot m^2}{coul^2}$$



Solution:

$$F = K \frac{q_1 q_2}{r^2}$$

$$F = 9 \times 10^{9} \frac{(2 \times 1.6 \times 10^{-19})(2 \times 1.6 \times 10^{-19})}{(10^{-13})^2}$$

$$F = 9 \times 10^{9} \times 3.2 \times 3.2 \times 10^{-38} \times 10^{26}$$

$$F = 0.092 \text{ Nt}$$