Electrostatics

i.e; Study of the charge at rest.

* Charge :- like mass it is an ~~intensive~~ (intrinsic) property of a body through which it interacts with another body.

⇒ How a charge appears on the body?

Ans: Charge appears on the body either by the transfer of electrons (gain or loss) of by the shifting of electrons on the body.

⇒ ~~Properties of~~ Charge :-

1. Charge is of two types :- positive and negative

(i) Charge on electron :- $-1.6 \times 10^{-19} C$

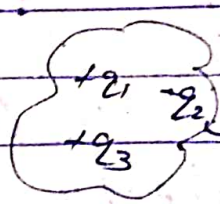
(ii) " " proton :- $+1.6 \times 10^{-19} C$

2. Like charges repel each other while unlike charges attract each other.

Charge is a scalar quantity.

i.e, it obeys algebric sum.

Eg:- Total charge $= q_1 - q_2 + q_3$



VI

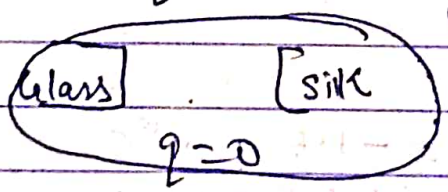
A. charge of an isolated system is conserved

Eg:-

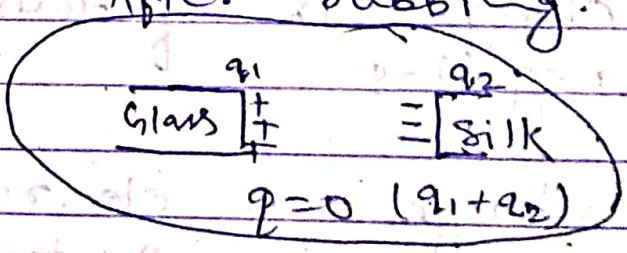
(i) When a glass rod is rubbed with silk, due to transfer of electrons, glass rod gets positive charge and the same amout of negative charge appears on the silk.

i.e; total charge of glass-silk system is conserved

Before Rubbing



After rubbing.



(ii) $_{92}U^{235} + {}_{0}n^{1} \longrightarrow {}_{56}Ba^{141} + {}_{36}kr^{92} + 3{}_{0}n^{1}$
$+ 200\ Mev.$

Bef of collision
$np = 92$

After collision
$np = 56 + 36 = 92$

i.e; before and after collision charge is conserved.

(iii) Annihilation

$e^{+} + e^{-} \longrightarrow \gamma$-ray photon: Electromagnetic wave.

An electron and protons combines to form a γ-ray photon called annihilation.

Total charge before and after remains conserved.

(iv) Pair Product

γ-ray $\longrightarrow e^{+} + e^{-}$

A γ-ray photon materialises into protons and electron — called pair production.

(vii)

5 Changes is quantized i.e charge appears on the body; $q = \pm ne$

Yes - Integral multiple of electronic charge.

i.e; $q = \pm ne$

where n is an Integer

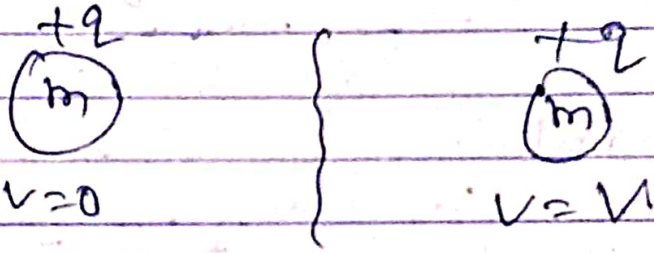
i.e $n = 1, 2, 3 \ldots$

i.e n $\neq$ fractional ($\frac{1}{2}$, 10.5

'n' is an integer because transfer of electrons cannot be fractional.

6. Charges is transferable in nature.

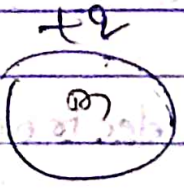
7. Charges is independent of speed of a body.



i.e, $q_{static} = q_{dynamics}$.

~~and~~

8. Accelerated charge particles radiates energy in the form of electromagnetic waves (E.M.W)



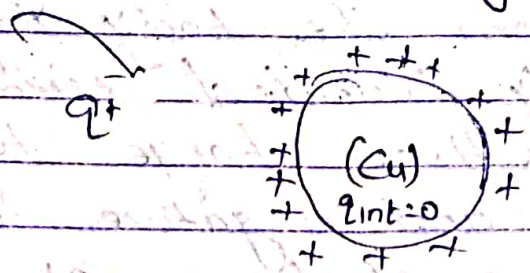
→ V = constant i.e, a = 0

→ V = variable i.e, a ≠ 0

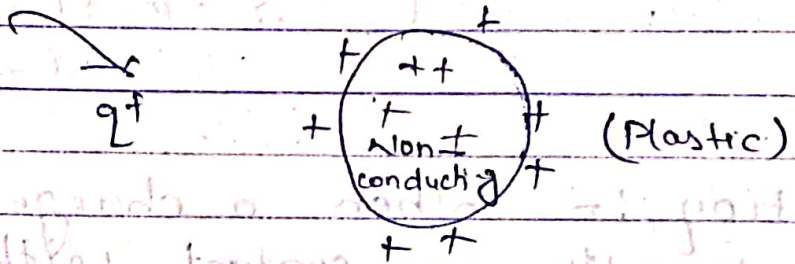
So, light produce.

9. Charge resides only on the surface of metal or conductor i.e, inside the metal

has
of conductor, no charge exists.



but in case of non-conducting material; charge resides on the surface as well as the material of the body.



10. Charge is associated with mass not the reverse is true.

i.e, If there is a charge, there is a mass but if there is a mass, there may be the charge.

⇒ Charging a body

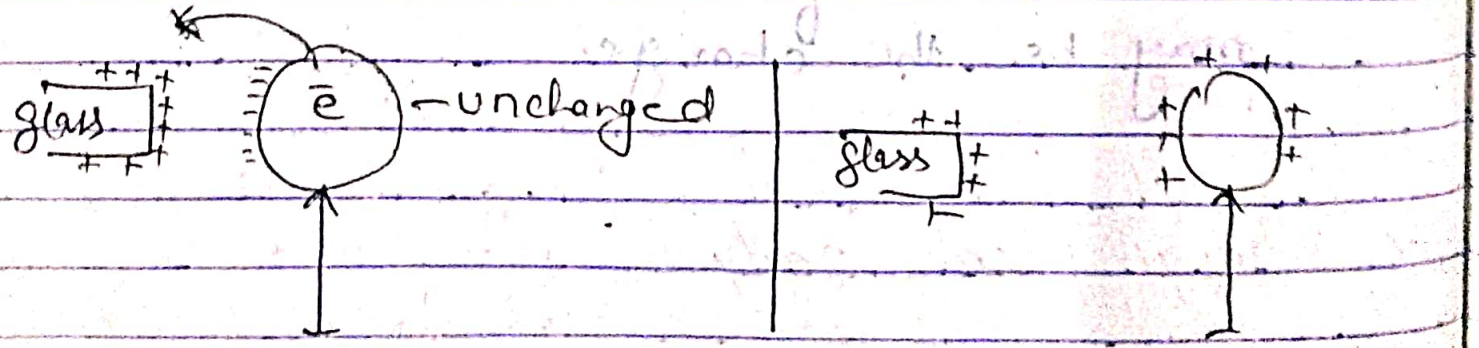
1. Friction: When a body is rubbed with

another body due to heat energy, electrons are detached from the body to which the electrons loosly bounded with nucleus. This result positive charge to the body loosing electron and negative charge to the body gaining electrons as for example when glass rod is rubbed with silk glass rod gets positive charge and silk gets negative charge.

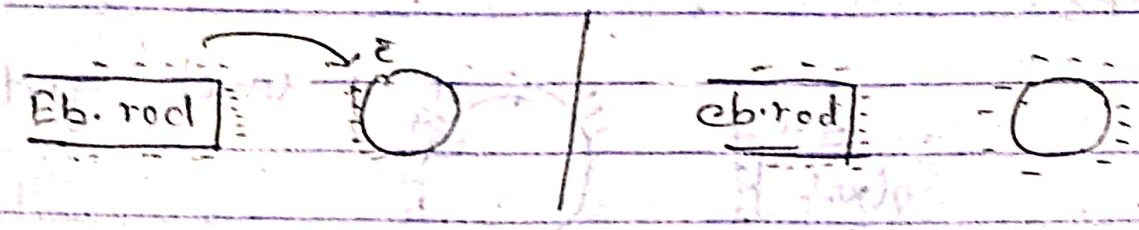
Eg:- Ebonite rod + Fur → Ebonite rod, fur
(−ve) (+ve)

2. Conduction :- When a charged body is kept phisically in contact with a uncharged body, due to transfer of electrons both the bodies are charged by the same sign of charge

Eg :- a) For Positively charged body.



(b) For negatively charged body:-



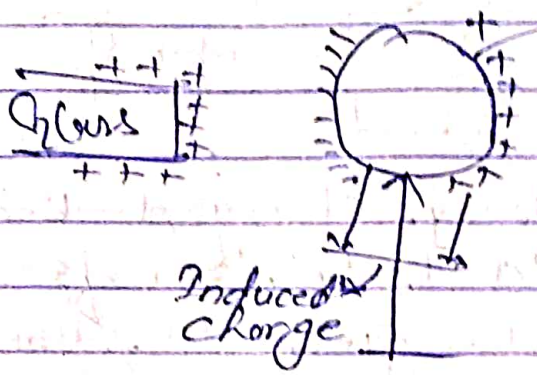
When a positively charged body is touch to a uncharged body transfer of electron occur from uncharged to charged body and hence both gets positive charge.

Such a changing of a body is parmayent.

Note:- Due to transfer of electron mass of a body is effected mass of a body is reduced when it gets positive charg and it increases when it gets negative charge

3. Charging by Induction:- When a charged body is placed close to a uncharged body due to redistribution of electrons the uncharged bodys gets charge, the close face gets charge of the opposite sign while the far face gets same sign of charge as that of the charge body, this is charging by induction and

the charge so appears called induced charges.

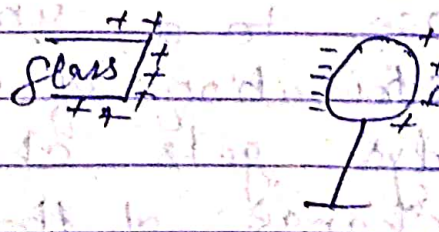


Induction is a tempory phenoyenon because on removing the charge; the charge on uncharged body disappears.

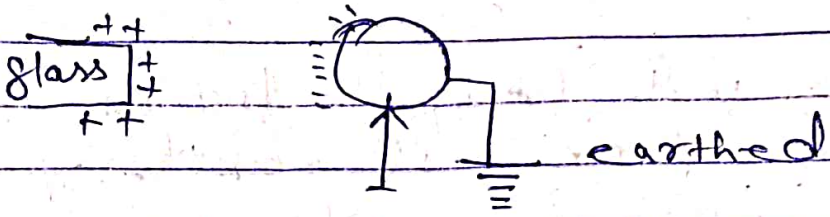
=> For charging by Induction pernayently:

They can be achieved by following four steps:-

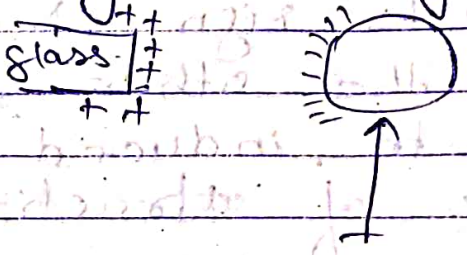
(a) Place a charged body near uncharged body — Induction occurs.



(b) Far faced is earthed



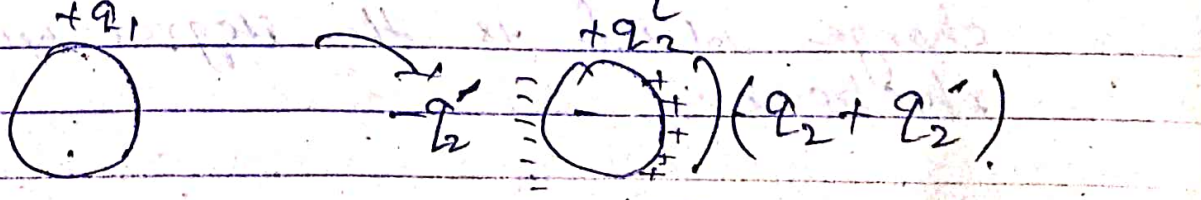
(c) Removing earthing.



(d) Remove the charge body.

ques:- Can two similar charge attract each other?

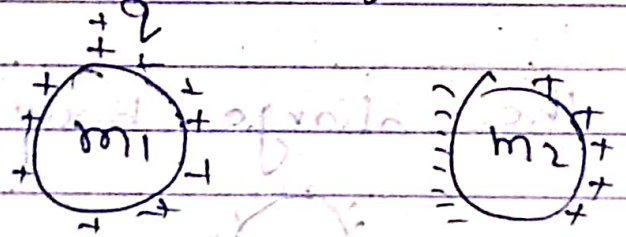
→ Yes, they can attracts with each other provided charge on one of the body is much larger than that of the other this is due to induction.



if, $+q_1 >> +q_2$ or, $q_1 = 10\,mC$
$q_2 = 10^{-4}\,C$

Ques:- A charged body attracts another body the other will uncharged or the have negative charge?

→ The other body will have either charge of opposite sign or it is uncharged, when the other body is uncharged due to induced charge there is a force of attraction between them.



Ques:- Why can one ignore quantisation of electric charge when dealing with macroscopic i.e, large scale charges?

Ans:- Large scale of charge i.e, charge in coulb is much larger than the charge appears due to the transfer of electrons hence the fractional amount of charge on the body ignores the conservation of charge which is the itegral multiple of electrons.