ES

- Presence of electrical charges-
  - -Stationary
  - -moving
  - -interaction
  - -by polition & mag.

- Electrons Protons Neutrons and Ions
  - -Electrons m_e : 9.1×10^{-31} Kg [1/1837 Mp]
    q_e : -1.6×10^{-19} C

- Protons

m_p : 1.7×10^{-27} Kg

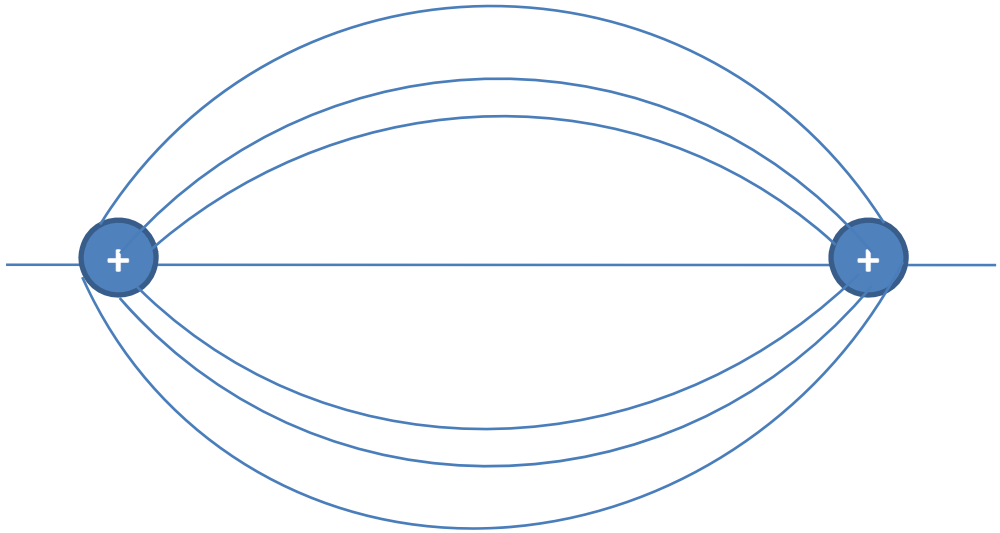
q_p : 1.6×10^{-19} C

Hydrogen- Simple Atom - $1e^-$ & - $1p^+$

- Good source of +ve ions
- Molecules are neutral
- Electro negative Cl,F,O Case of add e^-
- Electro positive H,Na,K Case of Release of e^-

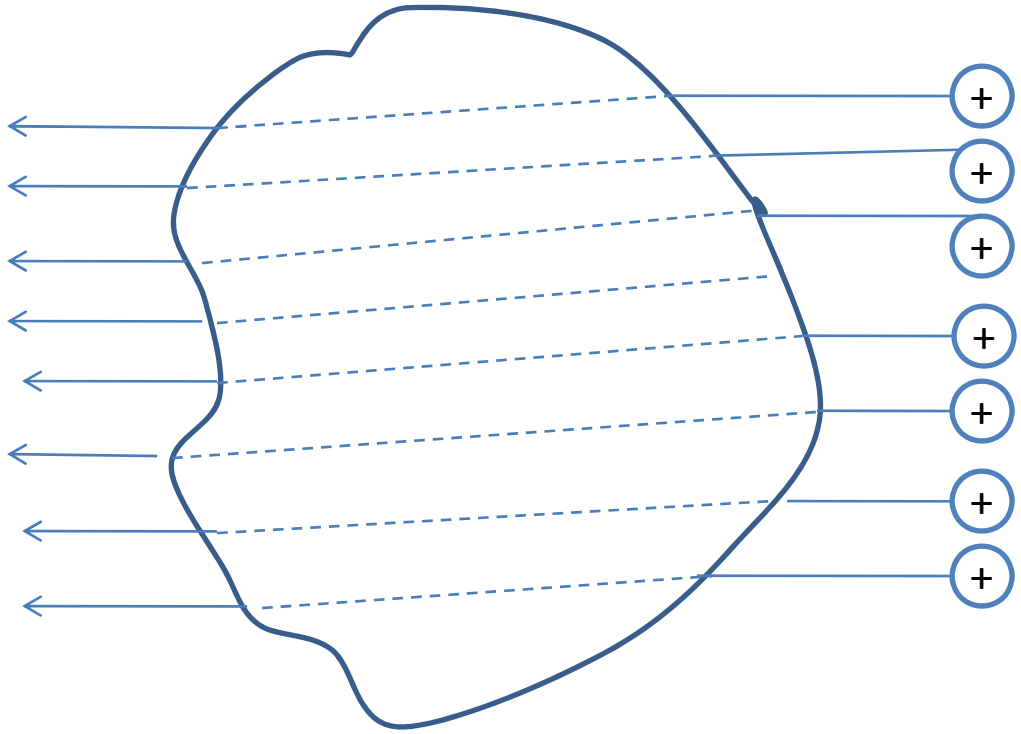
Ion- Charged particle of Atomic-Molecular Size

- Electric Fields



E= F/q N/c or V/m

Movement contributes current I- Net Charge per unit time



Per unit area - Current density J A/m^2

Solids – Rigidly held – subject to vibration

-heated – e^- are free to move – good conductor.
difficult to move – poor conductor.
do not move at all– Dielectric.

Conductivity- tells us this property

$$J = 6E \ A/m^2$$

$$E = \rho J \ V/m$$

Al	3.5×10^{7} S/m
Cu	5.8×10^{7} S/m
Ni	1.0×10^{6} S/m
Ag	6.1×10^{7} S/m
W	1.8×10^{7} S/m
Quartz	2×10^{-17} S/m
Wood	3×10^{-9} S/m

Conduction in Liquids:

Molten metal – free e^-

Liquids – ions

e^- released from Cathode from Cation

e^- absorbed at anode from Anion

Anion -- Anode
Cation -- Cathode

Current

$V = \mu E$ m/s where μ= mobility m^2/vs

$J = nqv$ A/m^2

$J = nq\mu E$

$= (n + q + \mu_+ + n_-q_-\mu_-) E$ A/m^2

$\sigma = (n + q + \mu_+ + n_-q_-\mu_-)$ S/m

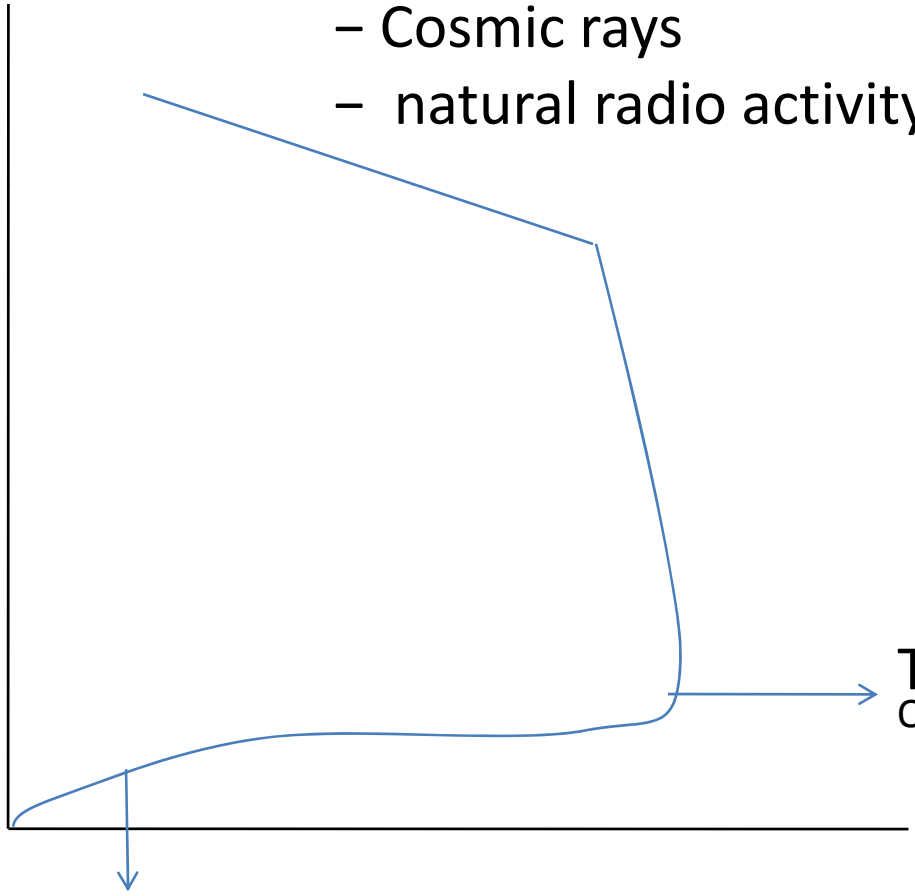
$\sigma\downarrow$ $\mu\downarrow$ $n\downarrow$

Conduction in Geses & vacuum:

Follows Liquid

All gases – have few ions and e^- present

- Cosmic rays
- natural radio activity



Corona

- Sharp points- radius of curvature is small
- E↑
- Corona

+ve

✓e^- are accelerated towards point

✓Ionize gas

-ve

✓e^- come from secondary emission

When close to other electrode- break down occur

Convective charging-Vande Graph Generator

Inductive Charging-

Insulators and Dielectrics

Low bulk Conductivity- Zero Conductivity

Good Insulators:

Quartz

Sulphur

Sealing wax

Clean Surface – Dry Surface

Reduce leakage – by deep Cut slots

$W = 1/2\ \epsilon E^2$

Bakelite 4.9

Porcelain 7.0