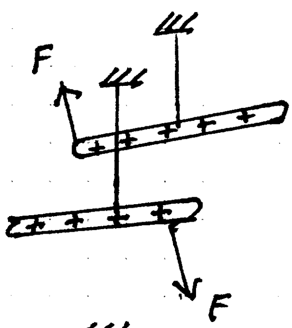
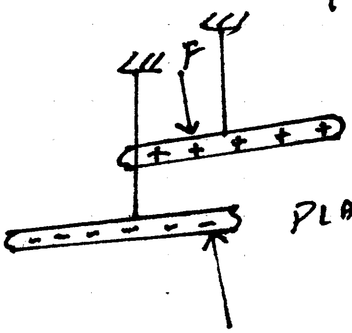
ELECTRIC CHARGE

REPULSION



A GLASS ROD RUBBED WITH SILK REPELS ANOTHE GLASS ROD

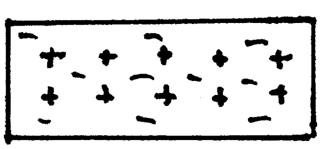
ATTRACTION



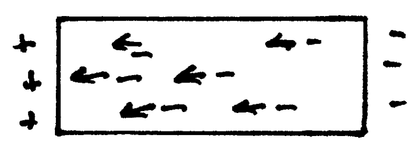
A PLASTIC ROD RUBBED WITH FUR ATTRACTS A GLASS ROD RUBBED WITH SILK

CHARGES WITH LIKE SIGN REPEL WHILE THOSE WITH UNLIKE SIGN ATTRACT EACH OTHER

METALS - INSULATORS - SEMI CONDUCTORS



+ IONS ARE FIXED
- ELECTRONS ARE FREE



FLOW OF ELECTRONS (WHICH ARE NEGATIVE) TO THE LEFT

INSULATORS – ALL ELECTRONS & IONS ARE FIXED IN SPACE & CANNOT MOVE

SEMI CONDUCTORS – ARE IN BETWEEN & CAN ACT AS CONDUCTORS FOR CERTAIN APPLIED VOLTAGES

COULOMB'S LAW

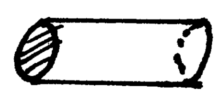
$$F = \frac{k|q_1||q_2|}{r^2} = \frac{1}{4\pi\epsilon_0}\frac{|q_1||q_2|}{r^2}$$

$\epsilon_0 = 8.85 \times 10^{-12}\ C^2/N\text{-}m^2$ PERMITTIVITY

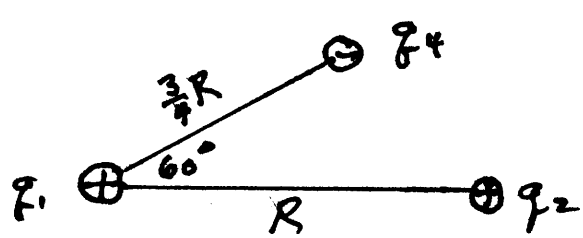
$$F = \frac{kq_1q_2}{r^2} \qquad k = 8.99 \times 10^9\ N\text{-}m^2/C^2$$

COULOMB DEFINITION - ONE COULOMB IS THE AMOUNT OF CHARGE THAT IS TRANSFERRED THROUGH THE CROSS SECTION OF A WIRE IN 1 SEC WHEN THERE IS A CURRENT OF 1 AMP IN THE WIRE

$$dq = i\,dt$$



EXAMPLE I

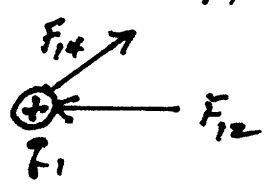


$q_1 = 1.6 \times 10^{-19} C$

$q_2 = 3.2 \times 10^{-19} C$

$q_4 = -3.2 \times 10^{-19} C$

$R = 0.0200 m$



$$\vec{F}_{12} = \frac{k|q_1||q_2|}{r_{12}^2}$$

$$\vec{F}_{12} = \frac{8.99 \times 10^9 (1.6 \times 10^{-19})(3.2 \times 10^{-19})}{(0.02)^2} = 1.15 \times 10^{-24}$$

$$\vec{F}_{14} = \frac{8.99\times10\,(1.6\times10^{-19})(3.2\times10^{-19})}{\left(\frac{3}{4}\right)^2(0.02)^2} = 2.05\times10^{-24}$$

$$\vec{F}_{14} = F_{14}\cos 60\, i + F_{14}\sin 60\, j$$
$$= 1.025\times10^{-24}\, i + 1.775\times10^{-24}\, j$$

$$\vec{F}_{1,NET} = \vec{F}_{12} + \vec{F}_{14}$$
$$= -1.15\times10^{-24}\, i + 1.025\times10^{-24}\, i + 1.775\times10^{-24}\, j$$

$$\boxed{\vec{F}_{1,NET} = -1.25\times10^{-25}\, i + 1.78\times10^{-24}\, j}$$

CHARGE IS QUANTIZED

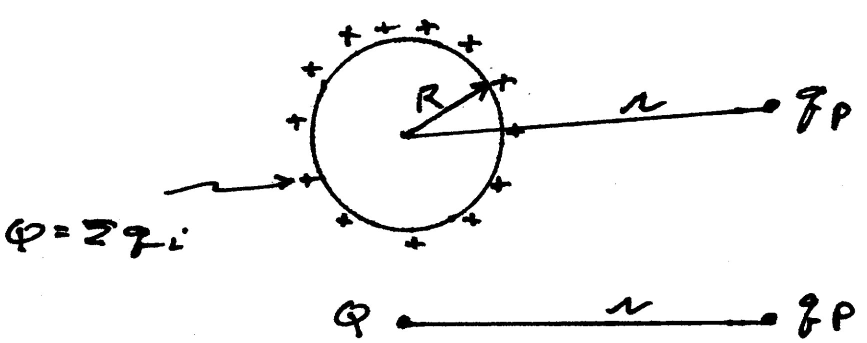
$q = ne \qquad n = \pm1, \pm2, + \cdots \pm n$

$e = 1.6\times10^{-19}$ C is THE CHARGE OF THE ELECTRON

SPHERICAL CONDUCTORS

thm I A SHELL OF UNIFORM CHARGE ATTRACTS OR REPELS A CHARGED PARTICLE THAT IS OUTSIDE THE SHELL AS IF ALL THE SHELL'S CHARGE WERE CONCENTRATED AT THE CENTER

$r > R$



thm II IF A CHARGED PARTICLE IS LOCATED INSIDE A SHELL OF UNIFORM CHARGE, THERE IS NO NET ELECTROSTATIC FORCE ON THE PARTICLE FROM THE SHELL