Phys 2120-4 8/27/12

Note Title 8/27/2012

Electromagnetism

EM Waves ⟹ Light, Optics

Use more calculus...

Topics

Electric Field (Coulomb's Law)

Electric Current

Magnetic Field

EM Induction

EM Waves → Light

Optics

"Modern Physics" (atomic level)

We study one particular force

force from elec. charges, elec currents

Aside from gravity all forces you experience are electrical

Start class w/ electrical forces at a fundamental simple level.

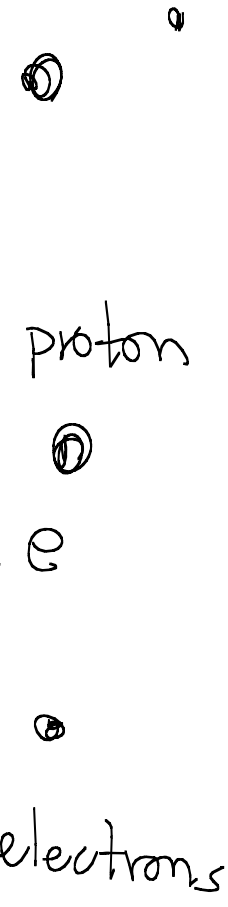
Electric Charge is a basic property of mass. (Like ~~mass~~)

All particles have a certain electric charge

We find: Particles in nature have charges which are multiples of e

(2 types of charge + and −)

Charge is quantized.



Charge is measured in Coulombs.

$e = 1.602 \times 10^{-19}$ Coulomb.

(Coulomb of charge is big

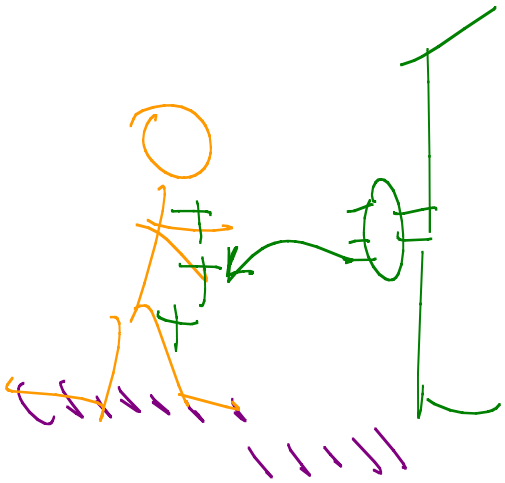
Charge can't be destroyed. (Conserved)

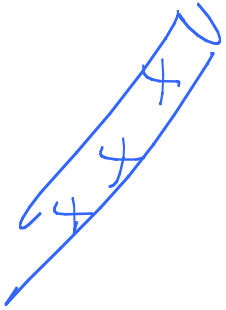
∴

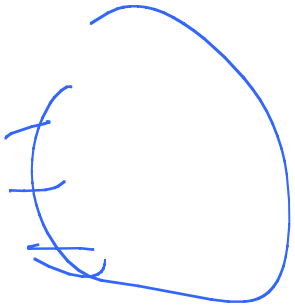
Charges of same sign repel

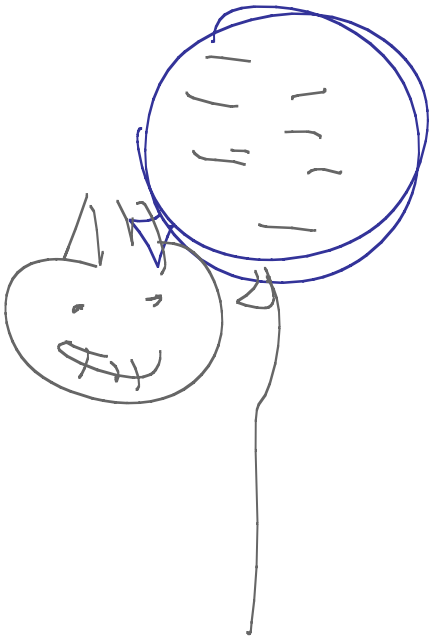
opp. sign attract.

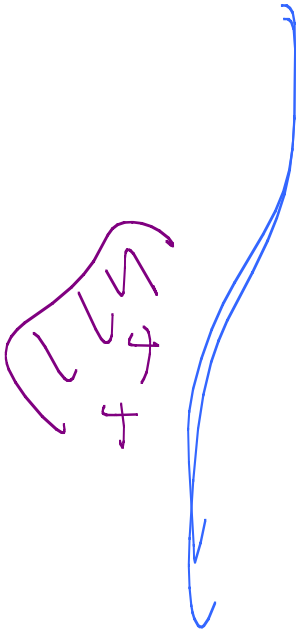
Normally in "life" charges cancel, don't see effects of electricity

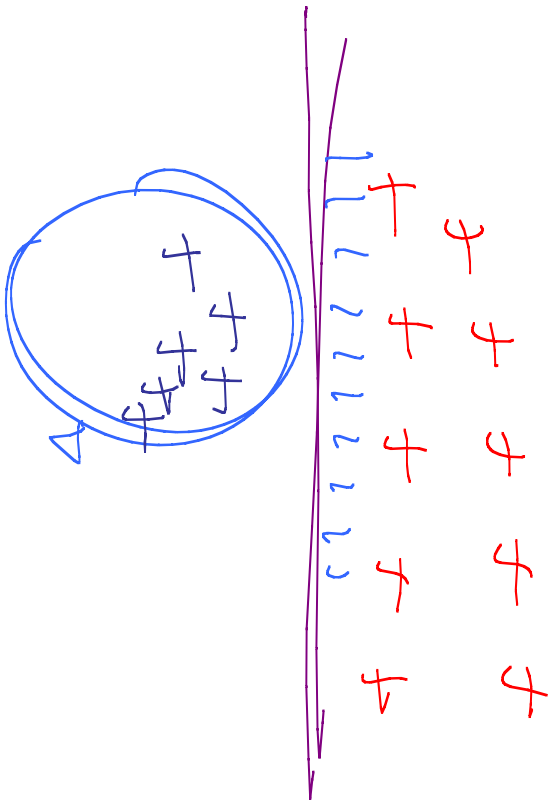








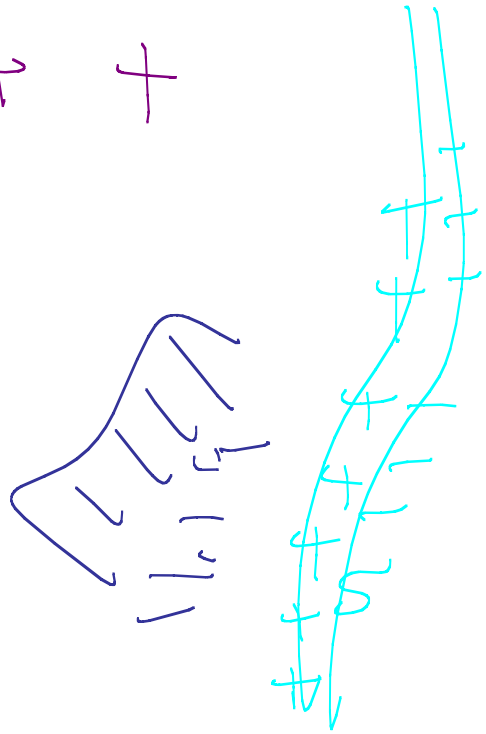




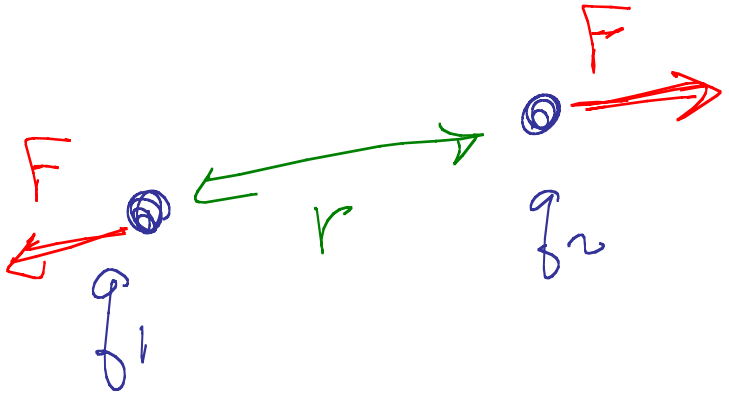
Wall becomes polarized

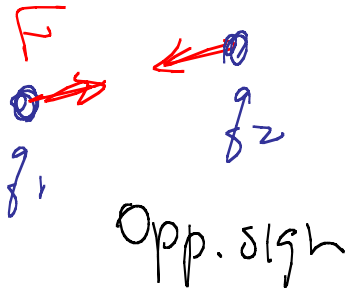
Attr than + =

Stronger + + than



Basic Law of Electrical Forces





$F \propto$ charges

$\propto 1/r^2$

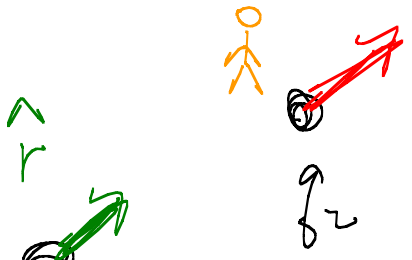
$$|\vec{F}| = k \frac{|q_1 q_2|}{r^2}$$

point charges

Same sign

$$k = 9.0 \times 10^9 \ \frac{Nm^2}{C^2}$$

$$\vec{F}_{1 \text{ on } 2} = k \frac{q_1 q_2}{r^2} \hat{r}$$



If repulsion

$\hat{r}$ points from 1 to 2

20.14 A typical lightning flash delivers about 25 C of neg. charge from cloud to ground.

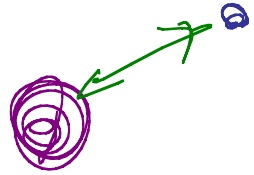
How many electrons

$$25\,C = (\#\ \text{electrons})(1.602\times10^{-19}\,C)$$

$$\#\ \text{elec} = \frac{25\,C}{(1.602\times10^{-19}\,C)} = \boxed{1.6\times10^{20}\ \text{elec}}$$

20.16 Electron & proton in a H atom are 52.9 pm apart.

Find magnitude of electrical force between them



$$|F| = \left| k\frac{q_1 q_1}{r^2} \right| = \left(9.0\times10^9 \frac{Nm^2}{C^2}\right)\frac{(1.602\times10^{-19}\,C)^2}{(52.9\times10^{-12}\,m)^2}$$

$$= 8.25\times10^{-8}\,N$$