Coulomb's law

ENGR 217

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1 Charge

Property of matter that causes matter to attract or repel other matter. Additionally, Charge is quantized; the smallest/unit charge is that of an electron or proton. ie. $1.602 \cdot 10^{-19}$

Coulumb's law

$\vec{F} = k\frac{q_1 q_2}{r^2}\hat{r}$: where $\hat{r}$ is a unit vector pointing from q to q_0. k = $9.988{\times}10^9 Nm^2/C^2$.

Superposition

$$\vec{F}_{tot} = \sum_i F_{q_i,q}$$

*Coulomb's Law describes the interaction for two point charges. THis principle states that the total force is the vector sum of all contributions of charges exerted individually.

- Total electric field P is the vector sum of the fields at P due to each point charge in the distribution.

Electric Field

A field is a physical quantity is assigned to every point in space.

- Tend to to extend over a volume and affect objects in said volume
- Quantity can be uniform or not throughout the entire volume
- Fields can have scalar or vector quantities

$$\vec{E} = \frac{\vec{F}}{q}$$

Find the total force on the refernce charge, and that would be the forced used to the determine the electric field the charge is experiencing.

- Electric field will point towards negative charges and away from positve charges
- $\vec{F}_{tot} = \sum_i F_{q_i,q}$

Work

General definition is "force acting through a distance." (Always a scalar quantity). W=qE * d (work on a charge = Force on charge times distance). **ELectric Potential** is the amount of work needed to move a unit of charge.

- Written as V (or sometimes φ), measured in Volts
- work per unit charge

$$\vec{F} = q\vec{E}$$

$$W = \vec{F}d = q\vec{E}d$$

$$V = \frac{W}{q} = \frac{q\vec{E}d}{q} = \vec{E}d$$

or more generally:

$$V = -\int_C \vec{E} \cdot dl$$

$$\vec{E} = -\nabla V$$