

PHYS 259: Notes
Electricity And Magnetism
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Coulomb's Law:

The magnitude of the force between 2 charges is proportional to the product of the charges on the 2 particles over the distance, r , squared or,

$$F_{1 \text{ on } 2} = F_{2 \text{ on } 1} = K \frac{|q_1||q_2|}{r^2}$$

where K is the electrostatic constant and $K = 8.99 \times 10^9 \text{ N} \cdot \text{m}^2 \text{C}^{-2}$ or equally

$$F_{1 \text{ on } 2} = F_{2 \text{ on } 1} = \frac{1}{4\pi\epsilon_0} \frac{|q_1||q_2|}{r^2}$$

where ϵ_0 is the permittivity of free space and $\epsilon_0 = 8.85 \times 10^{-12} \text{ s}^4 \cdot \text{A}^2 \cdot \text{m}^{-3} \cdot \text{kg}^{-1}$

Superposition Principle:

The total force on a charge is the vector sum of the individual forces acting on it.

$$\vec{F}_{\text{on } n} = \sum_{k=1}^{n-1} \vec{F}_{k \text{ on } n}$$

$$E = \int dE \cos \theta = \int_0^{2\pi r} dt$$

Gauss' Law:

The $\oint \vec{E} \cdot \vec{n} dA$

Capacitors:

A capacitor is any two electrodes separated by some distance. Regardless of the geometry we call the electrodes "plates". By convention a capacitor has equal and opposite charges on its plates, although technically this does not have to be true. The source charges on the capacitor plates create a uniform electric field between the plates of

$$\vec{E} = \frac{\sigma}{\epsilon_0}$$

The capacitance C of two parallel plates is given by $\frac{\epsilon_0 A}{d}$ where

$$Q = C\Delta V$$