# Electrostatics

1 Coulomb's law

The electrostatic force experienced by two charged particles is described by Coulomb's law. Since force is a vector quantity, we can include unit vector $\hat{r}$ in the formula to indicate the direction from one charge to the other.
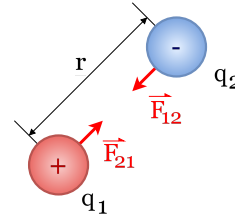
$$\vec{F} = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$$

We indicate *where* the force is coming from by using two subscripts: F_{xy}. For example, the force exerted by charge q_1 on charge q_2 is F_{12}. The signs of the charges determine whether the force will be attractive or repulsive

Repulsive: q_1, q_2 same signs
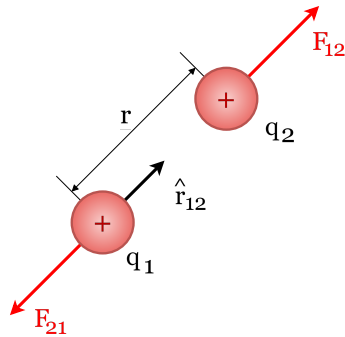
Attractive: q_1, q_2 opposite signs

Additionally, the sign of F on a given particle tells you whether that force is attractive or repulsive

- $-F \implies$ attractive force

- $+F \implies$ repulsive force

Random Formulas

$k_e = \frac{1}{4\pi\epsilon_0} = 8.987 \times 10^9 \frac{N \cdot m^2}{C^2}$

$F = qE$

$V = \frac{k_e Q}{r}$

$U = qV = k_e \frac{q_1 q_2}{r}$

$U_{cap} = \frac{1}{2}CV^2$