Similarities

Both proportional to $\frac{1}{r^2}$

Both have a constant factor: G / C

Both involve 2 objects.

Differences

Constants are different:

$G = 6.67 * 10^{-11}\ N\ m^2\ kg^{-2}$

$\frac{1}{4\pi\epsilon_0} = 9.00 * 10^{9}\ N\ m^2\ C^{-2}$

Objects are different:

masses $(m_1 m_2)$ / charges $(q_1 q_2)$

Gravitation

$$\vec{F} = G\frac{m_1 m_2}{r^2}$$

Two masses exert a force on each other, dependent on the distance apart.

Compare

Coulomb's Law

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

Two point charges exert a force on each other, dependent on the distance apart.

Proportionality

$$\vec{F} \propto \frac{1}{r^2} \qquad \vec{F} \propto q_1$$

Larger chargers lead to a larger force

A larger radius leads to a smaller force.

Change Radius

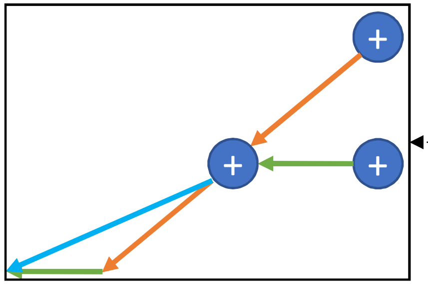
2 x Radius = 1/4 x Force	1/2 x Radius = 4 x Force

Change Charge

1/2 x Charge = 1/2 x Force	2 x Charge = 2 x Force

Principle of Superposition

The force on a charge is the sum of the forces due to all other point charges present.

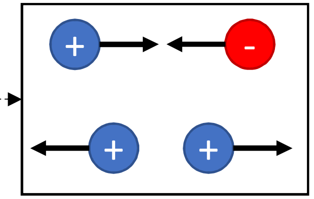


Newton's 3rd Law

$$F_1 = -F_2$$

Opposite charges attract.

Like charges repel.



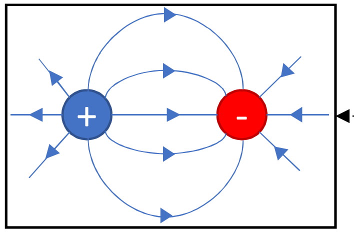
Electric Fields

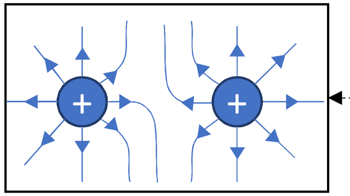
$$\vec{E} = \frac{\vec{F}}{q} = \frac{1}{4\pi\epsilon_0}\frac{q}{r^2}$$

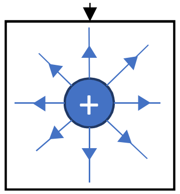
Charges produce electric fields. Charges in an electric field experience a force.

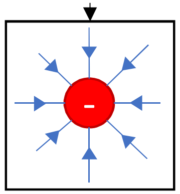
Electric Field Lines

Leave the source perpendicular to the surface in the direction of force a positive charge would experience. The field is stronger the closer the lines are together.

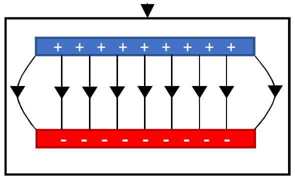








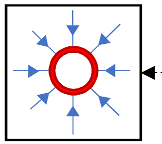
Finite Charged Plates



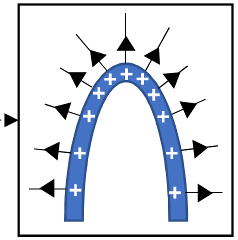
Conductors

Static charges in the conductor move so the net force on all charges is zero.

Hollow conductors have no electric field inside (if there is no charge in side).



Charges are closer together near a sharper point in a conductor, resulting in a stronger electric field.



Corona Effect

Large electric field near sharp points can ionize polar and non-polar molecules in the air, allowing charge to leave the conductor.