

Topic 5A: Electric Charge, Fields and Force

Skill 35: Coulomb's Law, Electrostatic Force

Charged object experience a force when they interact with another charged object

The size (magnitude) of the force depends on the

- the size of the charges (q_1 & q_2)
 - either given in problem or given as a particle... remember an electron or a proton is an elementary charge so it has a $q = 1.6 \times 10^{-19} \text{ C}$
- the distance between charges (r)
- the electrostatic constant (k) $k = 8.99 \times 10^9 \text{ N m}^2/\text{C}^2$

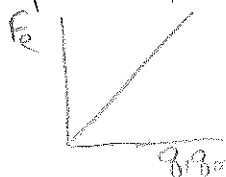
For pt. charges

→ Coulomb's Law $F_e = \frac{k q_1 q_2}{r^2}$

[Same behavior pattern as Universal gravity but due to charge instead of mass]

if both charges are the same F_e will be positive = repulsive
if charges are opposite, F_e will be negative = attractive

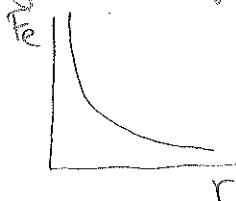
F_e is directly related to product of charges



F_e measured in Newtons

F_e is related to distance by inverse square

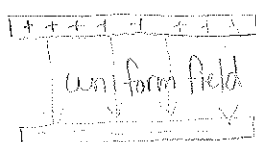
$$F_e \propto \frac{1}{r^2}$$



Between Parallel Plates

$$E = \frac{F_e}{q}$$

measured in N/C



Strength of "E" (Electric Field) is the same at all points between plates

- a positive test object will be forced toward negative plate
- a negative test object will be forced toward positive plate
- The Force is equal throughout but the acceleration will depend on the mass of an object.

An electron & a proton would experience equal but opposite force.

BUT → the electron would have a greater acceleration.

$$a = \frac{F_{\text{net}}}{m}$$