Coulomb's Law (Electric Force)

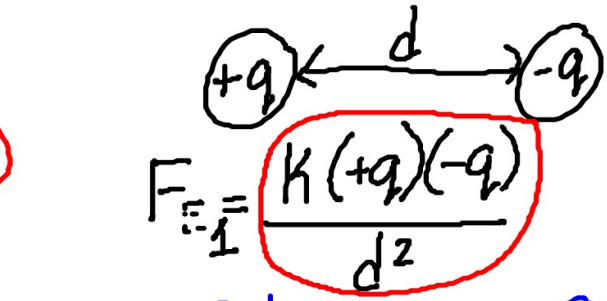
$$F_E = \frac{k\,q_1 q_2}{d^2}$$

- F_E: electric force (units: N)
- k: Coulomb's constant $8.99 \times 10^9 \frac{Nm^2}{C^2}$
- q_1, q_2: charges (units: C)
- d: distance between q_1 and q_2 (units: m)

Relationship

$d \uparrow, F_E \downarrow$ (b)

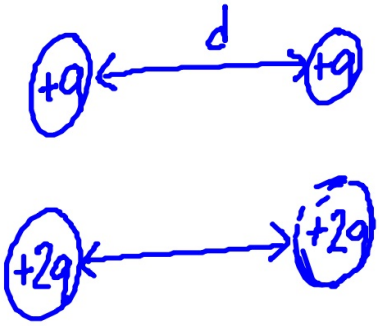
F_E proportional to $\frac{1}{d^2}$ (c)



$$F_{E_1} = \frac{k(+q)(-q)}{d^2}$$

$$F_{E_2} = \frac{k(+q)(-q)}{(2d)^2} = \frac{k(+q)(-q)}{4d^2}$$

$$F_{E_2} = \frac{1}{4} F_{E_1}$$



$$F_{E_1} = \frac{K(+q)(+q)}{d^2}$$

$$F_{E_2} = \frac{K(+2q)(+2q)}{d^2} = 4\frac{K(+q)(+q)}{d^2}$$

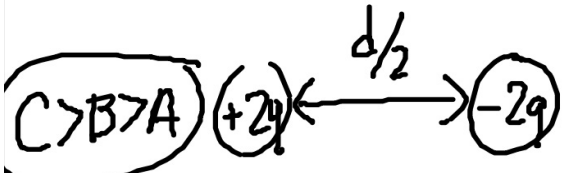
$$F_{E_2} = 4F_{E_1}$$

$F_E \uparrow$, $q \uparrow$

A attractive $F_E = \frac{K(-4q)(+2q)}{d^2}$

B repulsive

$$F_E = -8\frac{Kq^2}{d^2}\ A$$



C attractive $F_E = \frac{K(+3q)(3q)}{d^2}$

$$F_E = \frac{K(+2q)(-2q)}{(d/2)^2} = \frac{-4Kq^2}{\frac{d^2}{4}}$$

$$F_E = 9\frac{Kq^2}{d^2}\ B$$

$$F_E = -16\frac{Kq^2}{d^2}$$