Grade 12 physics V2

SPH4U

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Chapter 1

Electricity and Magnetism

1.1 Coulomb's Law

1.1.1 Background

Coulomb was a scientist who studied electricity in the early 1800's. He wanted to find out what factor affect the electrostatic force with two charged objects.

Coulomb based his experiment on Carendish's experiment.

To be able to perform the experiment Coulomb needed to electrically charge each of the pith balls and know the magnitude of the charge on each bal. His solution for this was to find the relative magnitude of the charge on each pith ball.

1.1.2 Formula

By measuring the amount of force, the separation distance between the charged objects and the relative charge of the pith balls, Coulomb was abl to find the following relationships:

$$F_E \propto \frac{1}{R^2}$$
$$F_E \propto q_1 q_2$$

We can bring these proportionalities together:

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

F_E is the magnitude of the electrical force in between two point charges
q_a and q_b is the absolute value of the charge of each object (in C)
R is the separation distance betweeen the objects (in m)
k is Coulomb's law constant of proportionality ($k = 8.99 \times 10^9 \frac{Nm^2}{C^2}$)

Remark. When using equations for electrical forces, don't substitute in the sign of the charge.