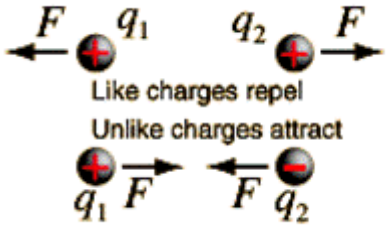
Coulomb’s law

Created: Saturday, 04 June 2011 12:18 | Published: Saturday, 04 June 2011 12:18 | Written by Super User | Print

Introduction to Coulomb’s law

The fundamental law of electrostatics states that the force between two charged particles is directly proportional to the product of their charges and inversely proportional to the square of the distance between them.



$$F = \frac{kq_1q_2}{r^2} = \frac{q_1q_2}{4\pi\varepsilon_0 r^2}$$ *Coulomb's Law*

where $?_0$ = permittivity of space

where **q_1** represents the quantity of charge on Object 1 (in Coulombs), **q_2** represents the quantity of charge on Object 2 (in Coulombs), and **r** represents the distance of separation between the two objects (in meters). The symbol **k** is a proportionality constant known as the Coulomb's law constant. The value of this constant is dependent upon the medium that the charged objects are immersed in. In the case of air, the value is approximately 9.0×10^9 N • m^2 / C^2. If the charged objects are present in water, the value of **k** can be reduced by as much as a factor of 80.

Description

The Coulomb's law equation provides an accurate description of the force between two objects whenever the objects act as**point charges.** A charged conducting sphere interacts with other charged objects as though all of its charge were located at its center. While the charge is uniformly spread across the surface of the sphere, the center of charge can be considered to be the center of the sphere. The sphere acts as a point charge with its excess charge located at its center. Since Coulomb's law applies to point charges, the distance**d** in the equation is the distance between the centers of charge for both objects.

Electric charge and Coulomb's law

Charge

- there are two kinds of charge, positive and negative
- like charges repel; unlike charges attract
- positive charge comes from having more protons than electrons; negative charge comes from having more electrons than protons
- charge is quantized, meaning that charge comes in integer multiples of the elementary charge e charge is conserved

The symbols Q_1 and Q_2 in the Coulomb's law equation represent the quantities of charge on the two interacting objects. Since an object can be charged positively or negatively, these quantities are often expressed as "+" or "-" values. The sign on the charge is simply representative of whether the object has an excess of electrons (a negatively charged object) or a shortage of electrons (a positively charged object).

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Reference links:

- http://www.en.wikipedia.org/wiki/Charge
- http://www.physics.about.com/od/glossary/g/electron.htm
- http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elefie.html#c3

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