

CONTAIN

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The science of electricity has its roots in the observation, known to Thales of Miletus in 600 B.C., that rubbed amber attracts bits of straw. The word "electricity" comes from the Greek word *elektron*, which means amber. It also evokes an image of modern technology, radio, television, microwave, etc. Electricity plays an ever deeper role in our lives, since according to atomic theory, the electric force plays a major role in holding atoms and molecules together to form liquids and solids.

In this chapter we will discuss the development of ideas about electricity. The charge on one elementary particle of an elementary nature is given the symbol e and is often referred to as the elementary charge:

$$e = 1.602 \times 10^{-19} \text{ C.}$$

Note that e is defined as a positive number, so the charge on the electron is $-e$. The charge on a proton, which is a charged part of the nucleus, on the other hand is $+e$.

The SI unit of charge is the coulomb. Charge of solids formulate like integral multiple of elemental charge e ,

$$Q = ne \quad (3-1)$$

where n is integer. The law of conservation of electric charge, which states, the law of conservation of electric charge, which states that the net amount of electric charge produced in any process is zero.

This conservation law is as clearly established as those for energy and momentum.

Ch. A. Coulomb (1736 - 1806) measured electrical attractions and repulsions quantitatively and deduced the law that governs them. He concluded, the force one charged object in vacuum (ideally a point charge) exerts on a second one is proportional to the product of the amount of charge on one, Q_1 , times the amount of charge on the other, Q_2 , and inversely proportional to the square of the distance r between them; that is

$$F = k \frac{Q_1 Q_2}{r^2} \quad (3-2)$$

where k is a proportionality constant, which is usually written in terms of another constant ϵ_0 called the permittivity of free space. It is found to be

$$k = \frac{1}{4\pi\epsilon_0} \quad (3-3)$$

Coulomb's law can be then written

$$F = \frac{1}{4\pi\epsilon_0} \frac{Q_1 Q_2}{r^2} \quad (3-4)$$

where

$$\epsilon_0 = 8.85418 \times 10^{-12} \text{ F m}^{-1}$$