

Charge

At the atomic scale, all matter contains a mixture of neutrons, positively charged protons, and negatively charged electrons. Charge is a physical property of matter. If an entity possesses charge, then it will experience a force if placed in an electromagnetic field.

We can ascribe to electric charge the following fundamental properties:

1. Charge can be either positive or negative.
2. The fundamental (smallest) quantity of charge is that of a single electron or proton. Its magnitude usually is denoted by the letter e .
3. According to the law of conservation of charge, the (net) charge in a closed region can neither be created nor destroyed.
4. Two like charges repel one another, whereas two charges of opposite polarity attract.

The unit for charge is the coulomb (C) and the magnitude of e is

$$e = 1.6 \times 10^{-19} \text{ (C)}$$

The symbol commonly used to represent charge is q . The charge of a single proton is $q_p = e$, and that of an electron, which is equal in magnitude but opposite in polarity, is $q_e = -e$. It is important to note that the term charge implies “net charge,” which is equal to the combined charge of all protons present in any given region of space minus the combined charge of all electrons in that region. **Hence, charge is always an integral multiple of e .**