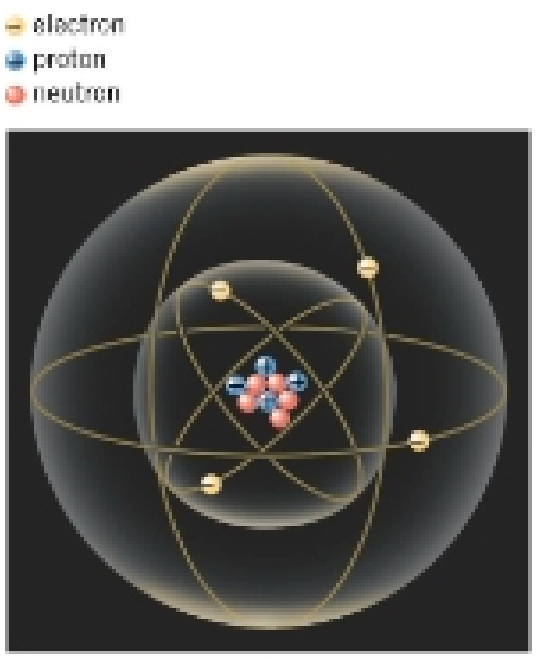
CHAPTER 18 - ELECTRIC FORCES AND FIELDS

Electric charge is produced when electrons are separated from neutral atoms so that one object has more electrons than protons and another has more protons than electrons.
The charge on the electron is negative so an excess of electrons gives an object a negative charge.
An object that has lost electrons so that it has fewer electrons than protons is considered to have a positive charge.
The basic unit of charge in the metric system is the Coulomb and corresponds to the amount of charge associated with 6.25×10^{18} electrons or protons.
The charge on one electron is $-e = -1.6 \times 10^{-19}$ C.
The charge on one proton is $+e = +1.6 \times 10^{-19}$ C.



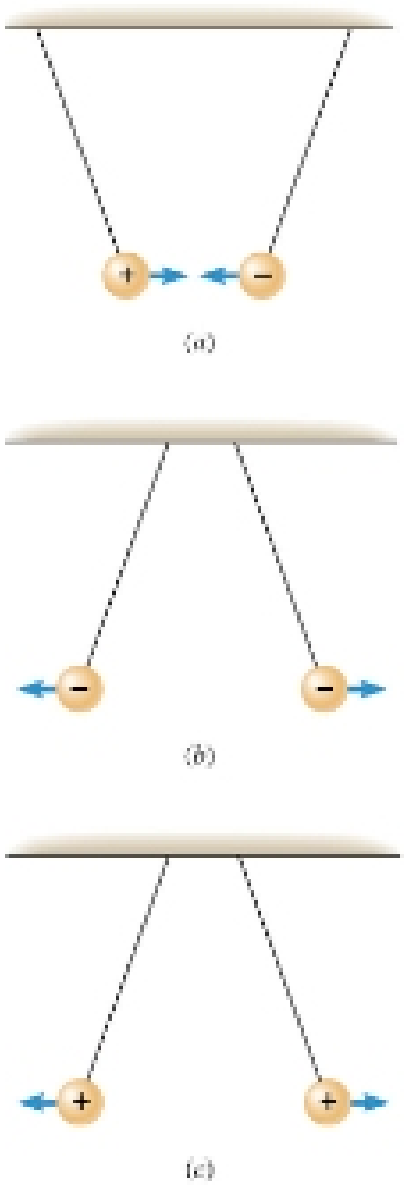
Above is an illustration of the positive nucleus surrounded by the negative electrons. If the number of electrons is the same as the number of protons the atom is said to be neutral.

Example

A metal plate has a charge of - 3.0 μC and a rod has a charge of + 2.0 μC. How many electrons must be transferred from the plate to the rod so that they have the same charge?
1 Coulomb is 6.25 x 10^{18} electrons.

The law of conservation of electric charge says that during any process, the net electric charge of an isolated system remains constant. Chemical reactions, electric circuits, and radioactive decay provide examples of this law.

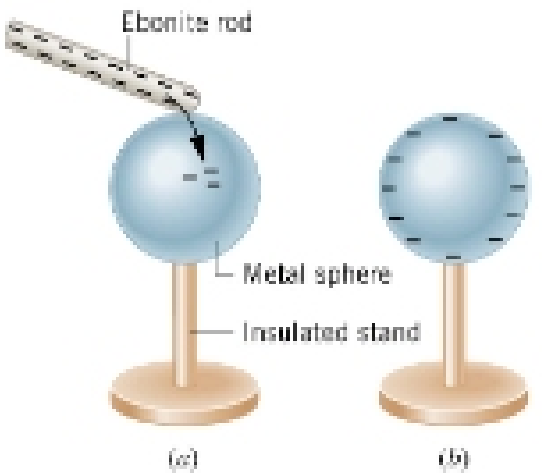
Fundamental characteristic of electric charges says like charges repel and unlike charges attract.



Electric conductors and insulators differ much in the same way heat conductors and insulators differ.

If a substance has electrons that are not tightly bound in molecules, these relatively free electrons can transmit electric energy as well as heat energy. In substances where these free electrons are not present, neither electric or heat energy is transmitted as well.

Two methods of placing an electric charge on an object are conduction and induction.
In charging by conduction, a charged object touches an uncharged object. Charge flows from the charged object to the uncharged object and they are both left with the same type of charge.



In charging by induction, the charged object is brought near the uncharged object causing electrons to be driven to or drawn from the ground. Once the grounding connection is removed and the original charged object is removed, a charge remains on the originally uncharged object opposite in sign to the original charge.