

### 1140: Overview of the size of atoms, etc.

Key words: charge of electrons; charge of nuclei; elementary charge; Coulomb force; size of nucleons; size of atoms; forces that make up atoms

[The forces that make up atoms]

No one has ever seen an atom directly but based on the observation of various physical quantities and the results of theoretical calculations, the following assumptions are made (it's more accurate to say that they are confirmed rather than assumed): An atom consists of electrons surrounding a nucleus.

An electron is an elementary particle with a charge of  $-1$ , measured in units of  $e$  ( $= 1.6022 \times 10^{-19}$  Coulomb [C]: elementary charge). It is confined around the nucleus by the Coulomb force, which is the attractive force caused by the positive charge of the nucleus. In other words, nucleons are bound together by nuclear forces, and the nucleus and electrons are bound together by the Coulomb force.

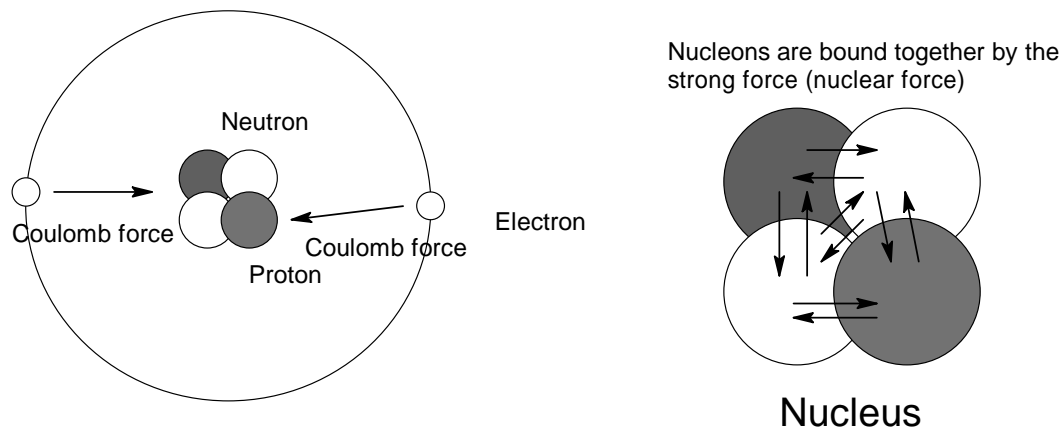


Figure 1. The forces that make up atoms

[Size of an atom]

The diameter of a nucleon is about  $10^{-15}$  m. Electrons are distributed about  $0.5 \text{ \AA}$  to  $1.5 \text{ \AA}$  ( $1 \text{ \AA} = 10^{-10}$  m) away from the nucleus, depending on the type of atom. Therefore, the size of an atom can be said to be about  $1$  to  $3 \times 10^{-10}$  m.

[Charge and relative mass of protons and electrons]

Electrons have a negative charge. The mass of an electron is about  $1/1836$  of that of a proton, but the absolute amount of charge is exactly equal to that of a proton.