The Atom

Each element is composed of a number of specific atoms. The numerics behind the number of atoms for every unit of an element, is discussed at the Mole page. Every atom is composed of a nucleus and an area called the electron cloud. The nucleus is the very center of the atom, and includes two particles, called the proton and the neutron. These two particles are almost equal in mass. The proton has a positive charge, the neutron a neutral charge (neither positive or negative), and the electron has a negative charge.

On the periodic table, atoms are organized according to the number of protons each atom has. The atoms with the fewest protons are in the upper left corner of the table. Moving across the table, or down the table, the number of protons in each atom increases. By moving these directions, the number of neutrons that exist in each atom's nucleus also increases. The notation that accounts for different combinations of the number of protons and neutrons is called isotopal notation.

Every element has at leat one isotope, or combination of the number of protons and the number of neutrons. When a different number of neutrons is found in an atom than the elemental atom, another isotope is found to exist. Some atoms have many different isotopes, while other atoms have only a few. Isotopal notation involves writing the element's symbol in the center, and the total mass of the element to the upper left corner of the element's symbol, and the number of protons of the atom to the lower left of the atom's symbol. Some examples of isotopes are shown below:

Elemental Isotope	Some Other Isotopes
Carbon - 12, $12_{6}C$	C-14, $14_{6}C$ and C-11, $11_{6}C$
Uranium-238, $238_{92}U$	U-235, $235_{92}U$ and U-234, $234_{92}U$
Silver-107, $107_{47}Ag$	Ag-108, $108_{47}Ag$ and Ag-111, $111_{47}Ag$

Isotopal notation is extremely helpful in analyzing radioactivity. As an atom loses mass through radioactive decay, the number of protons, or neutrons may change. Radioactivity is examined in isotopal notation at the radioactivity page.

The space outside the nucleus is called the electron field because it is where particles smaller than neutrons or protons exist in every atom. For a discussion of electron configurations and valences, read the following linked pages: Valences or Electron Configurations. The way that atoms or groups of atoms are symbolized for changes in the number of electrons in the electron cloud is by ionic notation.

An ion is an atom or group of atoms that has a net positive or negative charge. Net charges are created when elecrons are received or lost, not when protons are taken or added. Ionic notation involves writing the element's symbol in the center, with the net charge in the upper right corner. If an atom is deficient of electrons, it has a positive sign, and if no number is given it only has one less electron. A two next to the positive sign tells you it is deficient two electrons. If the ion has a negative sign, then it has an extra electron. The numbering mentioned earlier is similar here. Groups of atoms exist with ionic charges too.

Polyatomic ion is the name given to groups of atoms that collectively have a net positive or negative charge. Several of the more common polyatomic ions are listed below:

Name	Polyatomic ion
Acetate	CH_3COO^-
Ammonium	NH_4^+
Carbonate	CO_3^{-2}
Perchlorate	ClO_4^-

It is very important to not get confused between polyatomic ions and isotopes. Try and remember that the prefix

"iso" means equal, for an elemental isotope has an equal number of electrons as it does protons (not necessarily the same number of neutrons). The words "polyatomic ion" do not include the word "iso", and therefore will have a different number of electrons than its number of protons.

You can test your polyatomic ion and isotopal knowledge with this quiz!