

## When Elements Unite

Nearly everyone knows that elements combine to form chemical compounds. We shall try to explain the basic structure of elements to understand HOW they unite to form new and different substances.

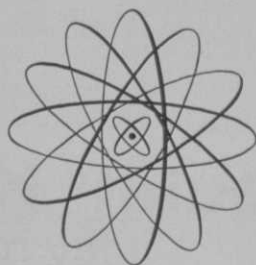
The atom is the building block of all chemical substances. It consists of a nucleus (very dense material) surrounded by orbiting electrons. Protons and neutrons form the nucleus and comprise most of the weight of the atom. Solid nuclear material the size of one's thumb would weigh 60 million tons.

Protons carry a positive electric charge; electrons a negative charge; neutrons, none. There is one electron for each proton. An element is made up of only one kind of atom.

All atoms have protons, neutrons and electrons (atomic particles). But the atoms of each element have a fixed number of each of the atomic particles. Sodium (Na) has 11 of each kind; chlorine has 17. When atoms from two (or more) elements combine, they form a molecule of a new chemical substance.

A molecule is the smallest portion of a compound that has the properties of the compound. Iron sulfide (FeS) is an example — one iron (Fe) atom interlocks with one sulfur (S) atom to form the iron sulfide (FeS) molecule.

Atoms lose, gain, or share electrons in the outer orbit (shell) to form molecules of new compounds. Iron (Fe) orbiting electrons unite with orbiting electrons of atmospheric oxygen (O) to form rust (iron oxide) that is well known to all. Atoms are classified into from one to seven groups according to the distance of their orbits (shells) from the nucleus and the number of electrons present. Only the electrons in the outermost group or shell can enter into combination. An atom with eight electrons in the outer shell (neon, for example) is inert and incapable of combination. An atom with seven outer electrons can combine with one that has one outer electron.



Oxygen Atom — nucleus (dot) is surrounded by two inner and six outer electron orbits.

Chemical union does not always occur when two elements simply are brought together. An iron rod shoved into a pile of sulfur will not produce iron sulfide, nor will water start to run when the gases of hydrogen and oxygen are mixed. Energy, usually as HEAT, either must be applied to, or is produced by, the reaction. Energy can not be created or lost — only transferred

Briefly, then, elements unite by electrical means when electrons in the outer orbit of atoms share orbits or are transferred to others. Elements lose their identity when they unite to form molecules of new chemical substances. (Sodium, a violently active metal, combines with chlorine, a poisonous gas, to form salt, a seasoning for food.)

*This elementary explanation, prepared with the help of Dr. and Mrs. William G. Mentzer (son-in-law and daughter, Ellen), is a modest introduction to a great chemical complexity. Continuation of this subject will be dependent upon reader response.*