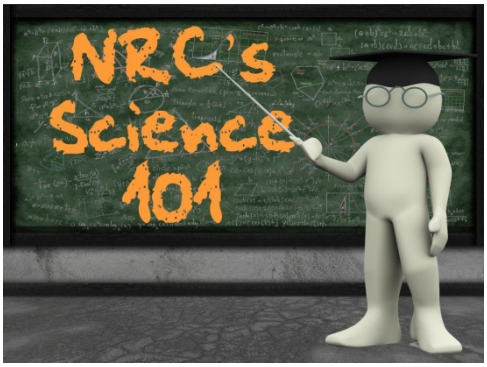
## The Nuclear Regulatory Commission's Science 101: What is an Atom?

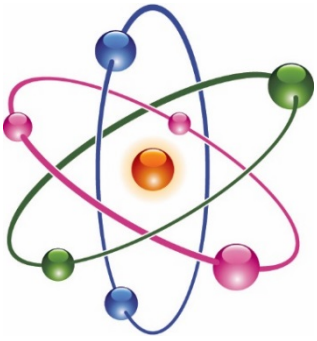



The atom is considered the basic building block of matter. Anything that has a mass—in other words, anything that occupies space—is composed of atoms. While its name originally referred to a particle that couldn't be divided any more—the smallest thing possible—we now know that each atom is generally made up of smaller particles. Given that these particles make up atoms, they are often referred to as subatomic particles. There are three subatomic particles: protons, neutrons and electrons.

Two of the subatomic particles have electrical charges: protons have a positive charge while electrons have a negative charge. Neutrons, on the other hand, don't have a charge. A fundamental rule is that particles with the same charge are repulsed from each other, while particles with opposite charges are attracted to each other. So, much like opposite ends of a magnet, protons and electrons are attracted to each other. Likewise, just as when you experience resistance trying to push the same ends of two magnets together, protons are repelled from other protons and electrons are repelled from other electrons.

The nucleus (or center) of an atom is made up of protons and neutrons. The number of protons in the nucleus, known as the "atomic number," primarily determines where that atom fits on the Periodic Table. The number of protons in the nucleus also defines in large part the characteristics of an atom—is it a gas or a metal, for example.

Two atoms with an identical number of protons in their nuclei belong to the same element. An element, like hydrogen, oxygen or iron, is a substance that cannot be broken down—outside of a nuclear reaction—into anything else. In other words, one element cannot be transformed into another (again, with the exception of nuclear reactions).



Now, while the protons are the same in an element, the number of neutrons may vary from atom to atom. The number of neutrons determines what isotope an atom is. This is important to the NRC because the number of neutrons relative to the protons determines the stability of the nucleus, with certain isotopes undergoing radioactive decay. While radioactive decay can occur in a variety of ways, it is, simply put, the process by which unstable atoms break down, releasing particles (and energy).

Generally speaking, atoms with roughly matching numbers of protons and neutrons are more stable against decay.

The nucleus of an atom is surrounded by a cloud of electrons. Remember, electrons are negatively-charged and are attracted to the positively-charged protons in the nucleus. An atom is considered to be electrically neutral if it has an equal number of protons and electrons. If an atom has a different number of electrons and protons, it is called an ion.

An important principle to know is electrons may be transferred from one atom to another or even shared between atoms (allowing atoms to bind together). These bonds allow for the formation of molecules, combinations of atoms (including those of different elements). Just as several atoms make up a molecule, many molecules make up a chemical.