



Coffee Break Training - Hazardous Materials

Understanding Atom Composition

No. HM-2012-5 November 19, 2012

Learning Objective: The student shall be able to explain atomic number and atomic mass.

The **atom** is the smallest constituent of an element that can be broken down no further and still retain the properties of that element. All elements are composed of atoms.

The atom consists of **protons, neutrons** and **electrons**. The **nucleus** of the atom contains the protons and neutrons and is where the **positive charge** resides. The **electrons** orbit the nucleus and contain the **negative charge** of the atom.

Protons are found in the nucleus. They have an atomic mass of 1, an electrical charge of +1 and there is always the same number of protons within an atom of a given element: a material that cannot be broken down into simpler material by chemical means.

Neutrons also are found in the nucleus. They have an atomic mass of 1, have no electrical charge and the number of neutrons within the nucleus of a given element can vary.

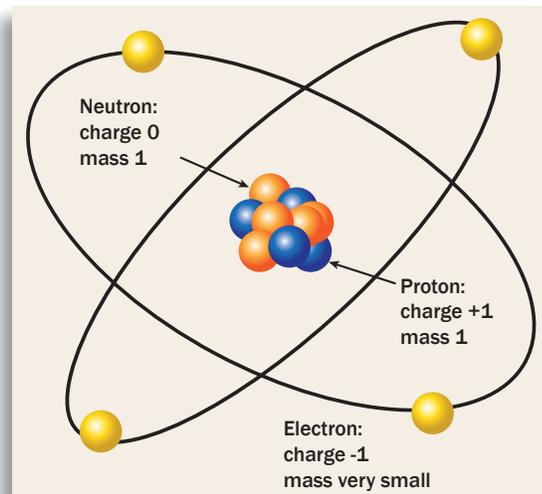
Electrons are found in orbit around the nucleus. They are essentially weightless (1/1840 of the proton), have an electrical charge of -1 and possess negligible mass.

The **atomic number**, which indicates the number of protons in the nucleus of the atom, is referred to in some reference books as the “Z” number. Electrons must equal the number of protons; therefore, the atomic number also indicates the number of electrons in the **neutral** atom. The **atomic number** equals the number of protons and equals the number of electrons.

The **atomic mass** of the atom is the total of protons and neutrons contained within the nucleus of that atom. It is the weight of the nucleus, since the majority of the weight is contained in the protons and neutrons. The **mass number** refers to the number of protons plus the number of neutrons. In some reference books, this number is identified as the “A” number.

The number of neutrons in the nucleus of an atom may vary, but the number of protons always will be the same. When the number of neutrons varies from the number found in the most stable form of that element, it is called an **isotope**. Atomic mass is rounded to the nearest whole number.

For additional information, you can enroll in the National Fire Academy’s (NFA’s) Online self-study course *Foundational Concepts in Chemistry (Q228)* found at <http://www.usfa.fema.gov/nfa/nfaonline/browse/hazmat.shtm>



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www.usfa.fema.gov/nfa/coffee-break/