

The following are the terms you should be familiar with in order to properly complete this unit. You are expected to be able to define each as well as apply these terms in any situation during this and subsequent units of study.

element - A type of pure substance in which all the atoms are alike.

nucleus - The center of an atom that has most of the mass of the atom.

proton - A positively charged subatomic particle found in the nucleus of an atom. Mass is about 1 amu.

atomic number - Represents the number of protons in the nucleus of an atom of an element.

neutron - A neutral subatomic particle found in the nucleus of an atom. Mass is approximately 1 amu.

average atomic mass - The number that represents the average mass of all the naturally occurring isotopes of an element.

atomic mass number - The sum of the protons and neutrons in an atom. Basically the average atomic mass, only rounded to the nearest whole number.

atomic mass unit (amu or u) - A unit of mass defined as one-twelfth the mass of a carbon-12 atom.

quarks - Very small particles that make up protons and neutrons.

electron - A subatomic particle that moves freely around the nucleus of an atom and has a negative charge. Mass is approximately 1/2000 amu.

electron cloud - The region surrounding the nucleus of an atom, which represents the most probable location of the electron.

energy level - A term used to describe each of the fixed amounts of energy an electron in an atom may have. Electrons in the lowest energy level have the least amount of energy. Those in lower energy levels are more likely to be found closer to the nucleus than those in higher levels.

isotopes - Atoms of the same element with different numbers of neutrons.

allotropes - Different structural forms of the same element.

chemical symbol - A notation of one or two letters that represents an element. The first letter is capitalized and the second letter is lower case.

mole - The SI unit used to measure the amount of a substance. The number of atoms in 12.000 g of carbon-12, which is equal to Avogadro's number (6.02×10^{23}).

radioactivity - The spontaneous decay of an unstable nucleus accompanied by the emission of radiation.

nuclear radiation - High-energy particles or rays emitted during the nuclear decay processes.

alpha particle(α) - A positively charged particle (+2). A helium-4 nucleus ${}^4_2\text{He}$ or ${}^4_2\alpha$

which is made up of two neutrons and two protons. It is the least penetrating of the three common forms of radiation, being stopped by a sheet of paper. It is not dangerous to living things unless the alpha-emitting substance is inhaled or ingested or comes into contact with the lens of the eye.

beta particle(β^- or β^+) - An electron of either positive charge ${}^0_{+1}\text{e}$ (**positron**) or negative charge (**electron**) ${}^0_{-1}\text{e}$ which has been emitted during the radioactive decay of a neutron from an unstable nucleus.. Beta particles are more penetrating than alpha particles but less than gamma rays or x-rays.

gamma ray (γ) - A highly penetrating type of nuclear radiation, similar to x-radiation, except that it comes from within the nucleus of an atom, and, in general, has a shorter wavelength and high energy.

neutron emission – Release of a high-energy neutron by some neutron-rich nuclei during radioactive decay

half-life - The time required for half the atoms of a particular radioactive nuclei to decay. The half-life is a characteristic property of each radioactive isotope. Shorter half-life = less stable

nuclear fission - The splitting of a heavy nucleus into two roughly equal parts (which are nuclei of lighter elements), accompanied by the release of a relatively large amount of energy in the form of kinetic energy of the two parts and in the form of emission of neutrons and gamma rays.

nuclear fusion - The process by which multiple light nuclei join to form a heavier nucleus. It is accomplished by a release or absorption of energy. Produces more energy than fission. Occurs naturally in stars.

strong nuclear force – Force that binds protons and neutrons together in the nucleus.

nuclear chain reaction - A reaction that, once initiated, sustains itself and expands.

This is a reaction in which reactive species, such as radicals, are produced in more than one step. These reactive species, radicals, propagate the chain reaction.

critical mass – Refers to the smallest amount of a substance that can undergo a fission reaction, but also sustain a chain reaction

radioactive tracer - A small amount of radioactive isotope introduced into a system in order to follow the behavior of some component of that system.

nuclear reactions - Process by which two nuclei or nuclear particles collide to form products different from the original particles.

nuclear decay - The change of one radioactive nuclide into a different nuclide by the spontaneous emission of alpha, beta, or gamma rays, or by electron capture. The end product is a less energetic, more stable nucleus. Each decay process has a definite half-life.