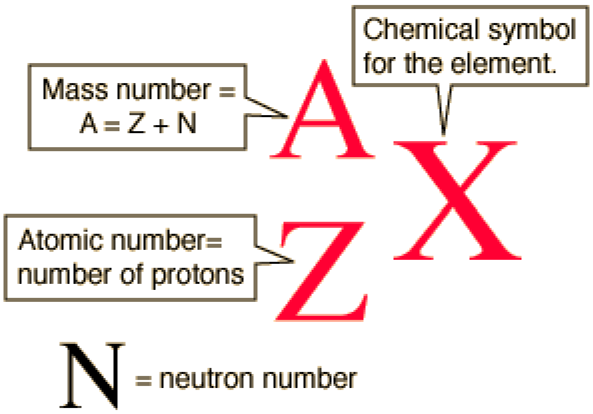
Nuclear Notation

Standard nuclear notation shows the chemical symbol, the mass number and the atomic number of the isotope.



Example: the isotopes of carbon. The element is determined by the atomic number 6. Carbon-12 is the common isotope, with carbon-13 as another stable isotope which makes up about 1%. Carbon 14 is radioactive and the basis for carbon dating.

$^{12}_{6}C$

$^{13}_{6}C$

$^{14}_{6}C$

Index

The mass of an element that is numerically equal to the atomic mass A in grams is called a mole and will contain Avogadro's number N_A of nuclei. If the density ρ of the material is known, then the number of nuclei per unit volume n can be calculated from $n = \rho N_A/A$. This is useful in calculating the cross section for nuclear scattering.

Atoms and elements

HyperPhysics***** Nuclear *R Nave* Go Back

Isotopes

The different isotopes of a given element have the same atomic number but different mass numbers since they have different numbers of neutrons. The chemical properties of the different isotopes of an element are identical, but they will often have great differences in nuclear stability. For stable isotopes of light elements, the number of neutrons will be almost equal to the number of protons, but a growing neutron excess is characteristic of stable heavy elements. The element tin (Sn) has the most stable isotopes with 10, the average being about 2.6 stable isotopes per element.

Information about the isotopes of each element and their abundances can be found by going to the periodic table and choosing an element. Then take the link to nuclear data.

Nuclear notation

Example: isotopic abundances of krypton

Index

HyperPhysics***** Nuclear

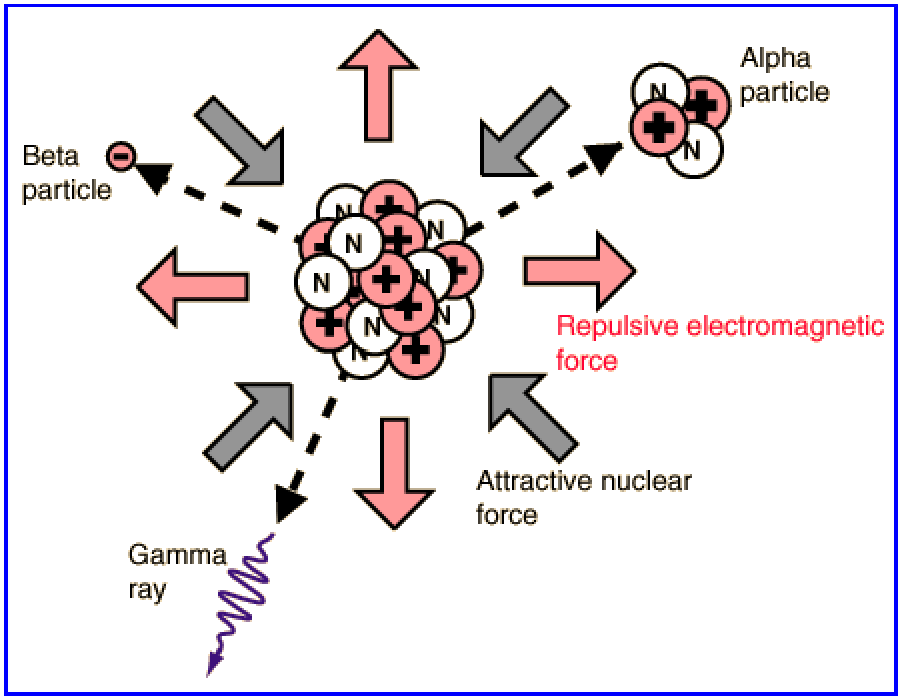
R Nave

Go Back

Index

Nuclear Forces

Within the incredibly small nuclear size, the two strongest forces in nature are pitted against each other. When the balance is broken, the resultant radioactivity yields particles of enormous energy.



Click on any of the text for more detail

The electron in a hydrogen atom is attracted to the proton nucleus with a force so strong that gravity and all other forces are negligible by comparison. But two protons touching each other would feel a repulsive force over 100 million times stronger!! So how can such protons stay in such close proximity? This may give you some feeling for the enormity of the nuclear strong force which holds the nuclei together.

Nuclear scale model

HyperPhysics***** Nuclear *R Nave* Go Back

Nuclear Size

The size of the nucleus compared to the size of the atom in which it resides is so small that it has invited a number of interesting comparisons. For example, the space inside an atom can be compared to the space in the solar system in a scale model. Scaling the gold nucleus suggests that the atomic radius is some 18,000 times the size of the nucleus. This great disparity in size was first discovered by Rutherford scattering of alpha particles off a thin

Index

gold foil. The extremity of this space comparison is highlighted by the fact that an atom with equal numbers of neutrons and protons, the nucleus comprises about 99.97% of the mass of the atom! Experimental evidence suggests that nuclear matter is almost uniform density, so that the size of a nucleus can be estimated from its mass number.	
HyperPhysics***** Nuclear *R Nave*	Go Back