

Nuclides & Isotopes

The atom's particles have the following masses:

$$m_p = 1.007276 \text{ u} = 1.672622 \cdot 10^{-27} \text{ kg} = 938.3 \text{ MeV}/c^2$$

$$m_n = 1.008665 \text{ u} = 1.674927 \cdot 10^{-27} \text{ kg} = 939.6 \text{ MeV}/c^2$$

$$m_e = 0.000548580 \text{ u} = 9.10938 \cdot 10^{-31} \text{ kg} = 0.511 \text{ MeV}/c^2$$

Note that m_n is slightly heavier than m_p so that n can decay into a p in its rest frame.

Z : Atomic Number = # protons in the nucleus (a neutral atom has Z e's)

N : Neutron Number = # neutrons " " "
 $\downarrow$
 responsible for the chemical properties

$$A = Z + N$$

A single nuclear species having specific values of both Z and N is called a **nuclide**.

Nuclides with same Z but different N are called **isotopes** of that element.

Different isotopes usually have slightly different physical properties such as melting and boiling temperatures and diffusion rates. The two common isotopes of uranium with $A = 235$ and 238 are usually separated industrially by taking advantage of different diffusion rates of gaseous uranium hexafluoride UF_6 containing the two isotopes.