Atomic Structure Review

Roles of Subatomic Particles

Protons (p^+): Particle that identifies the atom and pulls the inner and outer electrons towards the center of the atom.

Neutrons (n^o): Provide balance between the protons (p^+) themselves and the proton/electron interaction.

Electrons (e^-): Communication and bonding in the atomic structure

Isotopes

Every element is made up of multiple *isotopes*, forms of atom based on the relationship of neutrons and protons. All atoms of the same element have the same protons and electrons, but different numbers of neutrons.

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Atomic Stability – Z-Ratio (n^o:p^+ Ratio)

The Stability of an isotope of an atom is based on the relationship between protons (p^+) and neutrons (n^o) in an atom. Atoms with too many or too new n^o will become unstable.

Z-Ratio

Ratio between the protons (p^+) and neutrons (n^o) in the atom.

$$\text{Z-Ratio} = \frac{\#n^o\ (\textit{neutrons})}{\#p^+\ (\textit{protons})}$$

Most stable isotopes of elements have the following ratios:

Small (1 – 20): 1.0 – 1.2	Large (55 – 82): 1.4 – 1.5
Medium (1 – 54): 1.2 – 1.3	No Stable Isotopes Above 82

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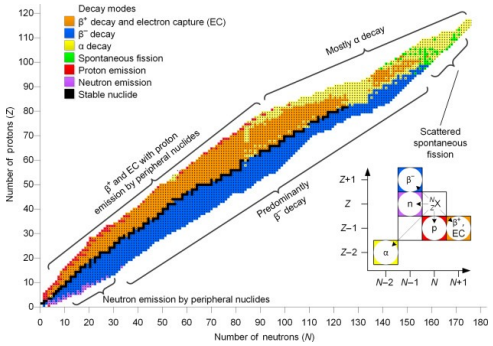
Z-Ratio (n^o:p^+ ratio) Graph



Nuclear Isotope Ratio Diagram

The chart shown to the left show the potential isotopes of a radioactive atom's isotopes. The colors indicate the type of decay process that occurs to make atom stable.

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Average Atomic Mass and Z-Ratios

The average atomic mass is based on the atomic mass of each isotope

$$\sum(\text{Atomic Mass} \times \text{Frac}_{\text{Abund}}) \quad \text{Frac}_{\text{Abundance}} = \frac{\%_{\text{Abundance}}}{100\%}$$

For most elements the most stable isotope *commonly* has the highest fractional abundance and is closest to the average atomic mass.

Element: Sodium (Na)

Average Atomic Mass	Stabile Isotope	Additional Isotopes
22.99amu	Sodium – 23	Na-22 Na-24
	Z-Ratio = 1.10	(*most common*)

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