Nuclear Chemistry

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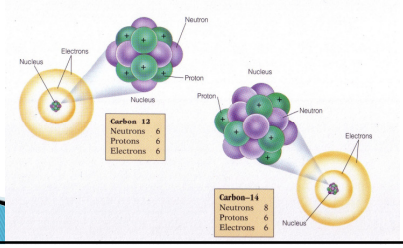
Atoms Review

- ***Atom*** – The building blocks of matter composed of protons, neutrons, electrons.
- ***Isotopes*** – Atoms of the same element that have different masses. (b/c of different # of neutrons)



The Nucleus

- Atomic nuclei are made from protons and neutrons, which are collectively called ***nucleons***.
- In nuclear chemistry, an atom is referred to as a ***nuclide***.
- Nuclides can be represented in two ways:

$^{228}_{88}Ra$ or Radium-228

Nucleons and Nuclear Stability

- The nuclides (atoms) on the PT can be stable, or unstable.
- Most elements in nature occur as mixtures of isotopes.
- All naturally occurring isotopes of elements with atomic numbers > 83 are radioactive.
- Beyond 83 amu, the repulsive force of protons is so great that no stable nuclides exist.
- However, some natural radioactive isotopes are also found among lighter elements.

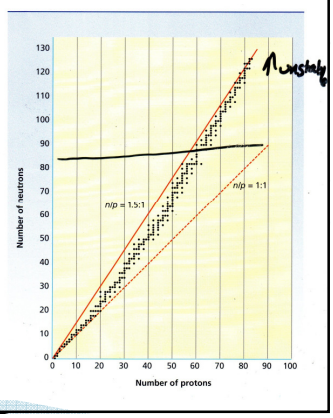
Band of Stability

- The ***band of stability*** is the cluster over a range of neutron-proton ratios.
- Unstable if neutron: proton ratio > 1.5:1

$^{4}_{2}He$	$^{206}_{82}Pb$
1:1 N:P ratio	1.5:1 N:P ratio

Band of Stabil

- This trend is a result of the relationship between the nuclear force and the electrostatic forces between protons.



Nuclear Reactions

- Unstable nuclei undergo spontaneous changes that changes their number of protons and neutrons.
- This process causes them to give off large amounts of energy which increases their stability.
- A nuclear reaction is a reaction that affects the nucleus of an atom.

Nuclear Reactions

- In an equation representing a nuclear reaction, the total of the atomic number and the total of the mass number must be equal on both sides of the equation.

$$^{9}_{4}\mathrm{Be} + {}^{4}_{2}\mathrm{He} \longrightarrow {}^{12}_{6}\mathrm{C} + {}^{1}_{0}n$$

Nuclear Reactions

- A ***transmutation*** is a change in the identity of a nucleus as a result in the change in the number of its protons.
- Remember that the ***Atomic Number*** is the ID number for an atom. Look @ PT….

Balancing Nuclear Reactions

- 1) $^{218}_{84}Po \rightarrow {}^{4}_{2}He + {}^{214}_{82}Pb$
- 2) $^{253}_{99}Es + {}^{4}_{2}He \rightarrow {}^{1}_{0}n + {}^{256}_{101}Md$
- 3) $^{142}_{61}Pm + {}^{0}_{-1}e \rightarrow {}^{142}_{60}Nd$
- 4) $^{9}_{4}Be + {}^{4}_{2}He \rightarrow {}^{1}_{0}n + {}^{12}_{6}C$

Balancing Nuclear Reactions

- 1) $^{238}_{92}U \rightarrow \square + {}^{234}_{90}Th$
- 2) $^{37}_{18}Ar + \square \rightarrow {}^{37}_{17}Cl$
- 3) $^{253}_{99}Es + \square \rightarrow {}^{1}_{0}n + {}^{256}_{101}Md$
- 4) $^{142}_{61}Pm + {}^{0}_{-1}e \rightarrow \square$

The End

- Intro to nuclear reactions
- Atoms
- Stability
- Balancing Nuclear Reactions