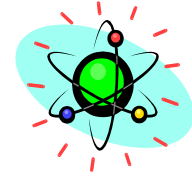


NUCLEAR REACTIONS



- Involve changes that occur within the nucleus of atoms
- Involve the greatest energy change of all types of reactions

TYPES OF NUCLEAR RXNS:

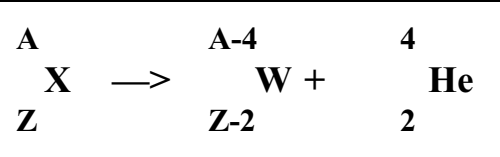
I. **Radioactive Decay** - the spontaneous decomposition of a nucleus

Two Types of Radioactive Decay:

1) **Alpha Decay**

- ▶ the process by which alpha (α) particles are emitted
- ▶ an α particle is the nucleus of a helium atom and consists of 2 protons and 2 neutrons,
- ▶ it has a +2 charge because it does not have any electrons

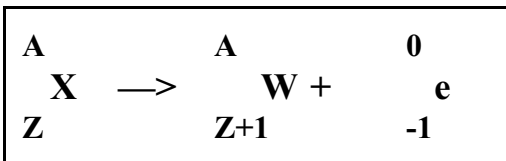
General Equation:



2) **Beta Decay**

- ▶ the process by which beta (β) particles are emitted
- ▶ a β particle is just an electron, ${}^0_{-1}\text{e}$

General Equation:



- the energy released in radioactive decay is in the form of gamma (γ) rays,
- γ rays have no mass or charge

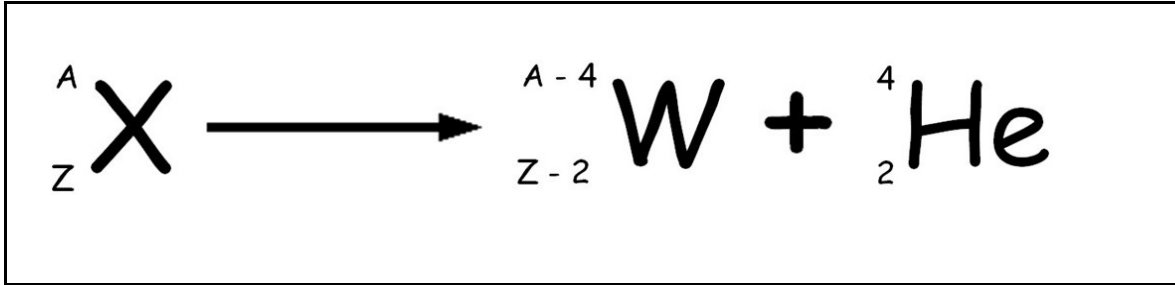
- II. **Artificial Transmutation** - the artificial bombardment of a nucleus by a small entity such as a helium nucleus, a proton, or a neutron
- this process can be used to produce atoms with a specific number of protons or neutrons
 - there are medical applications for these artificially designed nuclei
 - particle accelerators are used to move the bombarding particles at very high speeds so that they can overcome the repulsive forces between them and the target nucleus
- III. **Fission** - the SPLITTING of the nucleus of an atom
- the resulting atoms have smaller nuclei and huge amounts of energy are produced
 - power generating nuclear reactors use fission reactions
- IV. **Fusion** - the COMBINING of small nuclei to form a larger, heavier nucleus accompanied by the release of very large quantities of energy
- occurs in the Sun
 - releases enormous amounts of energy - more than that of fission

All types of nuclear rxns can be represented by a nuclear equation.

RULES FOR BALANCING NUCLEAR EQUATIONS:

- 1) The sum of the MASS NUMBERS (written as superscripts) on each side of the equation must balance.
- 2) The sum of the ATOMIC NUMBERS (written as subscripts) on each side of the equation must balance.

Once again:
the general equation for alpha decay is:



the general equation for beta decay is:

