

Nuclear Chemistry Unit Objectives

By the end of this unit, students will:

- Be able to explain that the stability of isotopes is based on the ratio of the neutrons and protons in its nucleus. Although most nuclei are stable, some are unstable and spontaneously decay emitting radiation
- Be able to identify the type of radioactive emission produced when a particular radioisotope decays (use “decay mode” on Table N)
- Be able to compare alpha particles, beta particles, positrons, and gamma radiation in terms of mass, charge, and penetrating power.
- Be able to determine decay mode, write, and balance nuclear equations.
- Be able to define *transmutation* as a change in the nucleus of an atom that converts it from one element into another
- Be able to distinguish between natural and artificial transmutations when given a nuclear equation.
- Be able to compare and contrast nuclear fission and fusion.
- Be able to classify a nuclear equation as fission or fusion.
- Be able to explain that the energy released during nuclear reactions is much greater than the energy released during chemical reactions, and results from the conversion of a fractional amount of mass into energy.
- Be able to identify some benefits and risks associated with nuclear fission and fusion reactions.
- Be able to compare and contrast the types of fission reactions (controlled or uncontrolled) that occur in nuclear reactors and atomic bombs.
- Be able to identify the component part of a nuclear reactor that allows for a controlled chain reaction, and describe its function.
- Be able to describe the inherent risks associated with radioactivity and the use of radioactive isotopes, such as biological exposure, long-term storage and disposal, and nuclear accidents.
- Be able to identify specific uses of some common radioisotopes, such as I-131, C-14, U-238, and Co-60
- Be able to describe what is meant by half-life and know some applications of half-life including radioactive dating.
- Be able to calculate the initial amount, the fraction remaining, or the half-life of a radioactive isotope when given two of the three variables.