Vocabulary: Radioactivity and the Weak Force

- Alpha decay – *nuclear decay* that results in the emission of an alpha particle.
    - An alpha particle consists of two protons and two neutrons. It is equivalent to a helium nucleus.
    - Alpha decay causes the mass number to be reduced by four and the atomic number to be reduced by two.

- Beta decay – nuclear decay that results in the emission of a high-energy beta particle from the nucleus.
    - There are two types of beta decay:
        - During β^- decay, a neutron is converted into a proton. A β^- particle (an electron) is emitted along with an electron antineutrino.
            - β^- decay increases the atomic number by 1 while leaving the mass number unchanged.
        - During β^+ decay, a proton is converted into a neutron. A β^+ particle (a positron) is emitted along with an electron neutrino.
            - β^+ decay decreases the atomic number by 1 while leaving the mass number unchanged.

- Electromagnetism – one of four fundamental forces, or interactions, in nature.
    - Electromagnetism governs the interactions between charged particles.
        - Electromagnetism causes attraction between opposite charges and between opposite magnetic poles.
        - Electromagnetism causes repulsion between similar charges and similar magnetic poles.

- Gamma decay – nuclear decay that results in the emission of a *gamma ray* or rays.
    - Gamma decay causes the nucleus to go from a high energy state to a lower energy state.

- Gamma ray – a high-energy form of electromagnetic radiation emitted during gamma decay.
    - Gamma rays have no mass and do not affect the composition of the nucleus.
    - Gamma rays are often emitted as a byproduct of other types of nuclear decay.

- Nuclear decay – the process in which a radioactive nucleus spontaneously releases particles and/or energy, resulting in a permanent change to the composition of the nucleus.
    - There are several types of radioactive decay. The most common are alpha decay and beta decay.

- Nucleon – a particle found in an atomic nucleus; a proton or a neutron.

- Phosphorescent – a material that emits light after being "stimulated" by heat, light, or an electric current.
    - Unlike fluorescent materials, phosphorescent materials continue to glow for a while after the source of stimulation is removed.

- Positron – the antiparticle of an electron.
    - A positron has the same mass and the opposite charge of an electron.
    - If a positron and an electron collide, they will annihilate each other in a burst of energy.

- Quantum tunneling – a mysterious process in which a particle can overcome a potential energy barrier that would be impossible to pass over according to classical physics.
    - For example, imagine rolling a ball down a small hill, with a larger hill on the other side.
        - Based on classical physics, the car will not have enough energy at the bottom of the first hill to make it over the larger hill.
        - Quantum physics states that there is a nonzero probability that the ball can make it over the larger hill.
    - Quantum tunneling occurs because of the *uncertainty principle*.

- Quark – an elementary particle that makes up protons, neutrons, and other baryons. (Baryons are heavy particles made up of three quarks.)
    - Quarks have fractional charge, either +⅔ or –⅓.
    - There are six types, or "flavors," of quarks in three generations:
        - Generation 1: up (charge +⅔) and down (charge –⅓.).
        - Generation 2: charm (+ ⅔) and strange (– ⅓.).
        - Generation 3: top (+ ⅔) and bottom (– ⅓.).

- Radioactive – capable of releasing radiation.
    - In a radioactive atom, the nucleus can spontaneously decay and emit particles and/or energy.

- Strong nuclear force – the force responsible for binding protons and neutrons together within the nucleus of an atom.
    - The strong nuclear force is also known as the strong force or the strong interaction.
    - The strong force is the most powerful of the four fundamental forces but only acts at very small distances within the nucleus of the atom.
    - The strong force is a byproduct of the *color forces* that bind quarks together within hadrons.

- Uncertainty principle – the idea in quantum physics that it is impossible to measure the position and momentum of a particle with complete accuracy at the same time.
- Weak force – a fundamental force that is responsible for beta decay in atomic nuclei.
    - The weak force is also called the *weak interaction*.