Answer on the question #68064, Chemistry / Physical Chemistry

Question:
a) Describe various types of radioactive decay.

Answer:
Radioactive decay is the process in which the parent atom (unstable atomic nucleus) losses energy by decomposition to more stable nucleus and radiation (alpha, beta and gamma particles). Usually, radioactive decays are divided into three main types: alpha, beta and gamma.

I. Alpha decay is typical for the heaviest elements, as alpha particle corresponds to the nucleus of helium-4 atom and has positive electric charge. Example:

$$^{210}_{84}Po \rightarrow {}^{4}_{2}He + {}^{206}_{82}Pb$$

II. Beta decay occurs with emission of an electron. During this process one neutron from the parent nucleus splits in proton and electron, so the number of protons increases by one, giving new element. Electron, or beta-radiation ionizes the atmosphere and can be stopped by wood. Example:

$$^{14}_{6}C \rightarrow {}^{14}_{7}N + e^{-} + \bar{\nu}_e$$

III. Gamma decay doesn't change the mass or charge of the parent atom, so usually it is just supplementary to alpha or beta decays. Gamma particles are the electromagnetic waves, similar to light but with much higher energy. Gamma rays are harmful for living organisms and must be stopped by lead. In contrast to alpha and beta radiation, it is not deviated by electric charge. The following example shows the gamma decay of metastable technetium-99. As gamma radiation doesn't have neither mass, nor charge, the mass and charge of the parent atom doesn't change. The whole effect is that the parent atom lowers in energy significantly.

$$^{43}_{99}mTc \rightarrow {}^{43}_{99}Tc + \gamma$$