Study Guide

You should understand the following terminology and notation: proton, neutron, nucleon, atomic number ($Z$), mass number ($A$), isotope, atomic mass unit ($u$), binding energy, radioactivity, decay constant, activity, half-life, alpha particle, beta particle, gamma ray, positron, neutrino. You should have a rough idea of the sizes and masses of nuclei and subnuclear particles, and of how much energy is typically involved in nuclear reactions.

Given the mass of a nucleus, you should be able to compute its binding energy. Given the masses of all the particles that participate in a nuclear reaction (such as a radioactive decay), you should be able to compute the amount of “energy released” in the reaction.

Unstable (radioactive) nuclei decay in a random fashion, with a certain fixed probability $\lambda$ of decaying per unit time. For a large sample of radioactive material, this implies that the number of nuclei remaining after time $t$ is

$$N(t) = N(0) \cdot e^{-\lambda t}.$$  

You should be able to determine from this equation how $\lambda$ is related to the half-life. By taking the derivative of this equation, you should also be able to derive the equation for the decay rate as a function of time.