

PHYS 4134, Fall 2016, Homework #4

Due Wednesday, September 28 2015, at 1:00 pm

1. Neutron decay

A neutron at rest decays into a proton, an electron, and an electron anti-neutrino. The decay energy is defined to be the difference in masses between the heavy parent and the lighter daughter particles. A) Calculate the decay energy. B) what will be the maximum kinetic energy of the proton? [See also problem 3.7]

2. Alpha decay

[Compare to problem 3.9 in the book.] ^{210}Po decays by emitting an alpha particle with a Q value of 5.407 MeV. Calculate the height B of the Coulomb barrier between the α -particle and the daughter nucleus assuming the nuclear potential has a sharp edge at a radius of $1.4A^{1/3}$ fm. Calculate the distance b beyond which the α -particle kinetic energy is positive.

3. Electromagnetic decay

Calculate the recoil energy of a nucleus, mass m , after it has emitted a γ -ray of energy E_γ . Hence, calculate the energy of the excited state of ^{12}C , which emits a 12,710 keV γ ray when it de-excites to the ground state. [See also problem 3.1]