Chemistry 485

Spring, 2o1o
Distributed: Wed., 10 Feb. 2o1o
(10 points)

Problem Set #4
Due: Mon., 15 Feb. 2o1o

1. The following questions consider the possibility of using decay heat from ^{238}Pu.
   (a) Calculate the specific thermal energy content of a sample of pure ^{238}Pu, that is, calculate the power in Watts given off by the alpha decay per kg of pure material.
   (b) Calculate the mass in grams of ^{238}Pu that would be needed to generate 470 W of thermal power in a radioisotope thermal generator (RTG) to be used on a spacecraft.
   (c) Unfortunately the conversion of thermal power to electrical power is rather inefficient, approximately 7% in most real devices. Calculate the mass in grams of ^{238}Pu needed to generate 470 W of electrical power for the spacecraft.
2. Calculate the classical turning point or distance of closest approach for an alpha particle at an energy of 5.4 MeV to a ^{234}U nucleus. This is the radial distance, r, at which the kinetic energy of the alpha particle is equal to the Coulomb potential energy ($V_C = Z_1 Z_2 e^2 / 4\pi\epsilon_0 r$).
3. What is the ratio of the classical turning point calculated above to the radius of a ^{234}U nucleus?