

Chemistry 485

Spring, 2010
 Distributed: Wed., 17 Mar. 2010
 (10 points)

Problem Set #6
 Due: Mon., 29 Mar. 2010

1. Notice that alpha decay is an example of a nuclear reaction in which the Center of Mass system (CMS) coincides exactly with the Laboratory System. (1) Calculate the recoil energy of the decay of the rare isotope ^{233}U that decays with $Q_\alpha=4.908$ MeV. (2) Calculate the Coulomb barriers for the reverse reaction in the CMS and in the Lab system.
2. Make a rough estimate of the reaction cross section in barns for the neutron capture reaction (n,γ) on ^{235}U at a neutron kinetic energy of 1 eV.
3. ^{32}P is a beta-minus emitting nuclide that is used extensively in biological and biochemical studies. This nuclide is made in nuclear reactors by the (n,α) reaction. The target material for the production is usually ammonium chloride (NH_4Cl) because it is a simple ionic solid. Determine all of the nuclear reaction products from (n,γ) and WHERE POSSIBLE (n,α) reactions on the six nuclei present in this sample. Use the format of the following table to present your results for the six isotopes in the sample.

Table 1: Table of target nuclei and products for neutron irradiation of NH_4Cl .

Nuclide	Isotopic Abundance	Nuclear Reaction	Reaction Product	Half-life
^1H	99.989%	(n,γ)	^2H	stable
^1H etc.	99.989%	(n,α)	NOT possible	