Assignment #1

Date Set:
Date Due:

Duderstadt & Hamilton:

2-2. A very important type of radioactive decay process in nuclear reactors is one in which fission products decay by neutron emission since such processes strongly influence the time behavior of the fission chain reaction. The slowest such decay process in most reactors is one characterized by a decay constant of 0.0126 sec^{-1}. Assuming that such a process controls the rate at which one can decrease the power level of a reactor, calculate the time necessary to decrease the reactor power level from 3800 MW (thermal) to 10 MW (thermal).

2-6. Boron is a common material used to shield against thermal neutrons. Estimate the thickness of boron required to attenuate an incident thermal neutron beam to 0.1% its intensity. (Use the thermal cross section data in Appendix A.)

2-9. Determine the number of scattering collisions a thermal neutron will experience on the average before being absorbed in H_2O, D_2O, ^{238}U, and cadmium, respectively.

2-10. How many mean free paths thick must a shield be designed in order to attenuate incident neutron beam by a factor of 1000?

2-20. Determine the fission-rate density necessary to produce a thermal power density of 400 kW/liter (typical of a fast breeder reactor core). Assume that the principal fissile isotope is ^{239}Pu.

1988 Final, Question 1:

Sketch the energy spectrum of neutrons in a typical reactor. Identify the dominant features qualitatively and quantitatively, focusing on the thermal, epithermal and fast spectrums, giving reasons for the shape of the spectrum and any other significant features. Why is this spectrum important in reactor analysis?