The University of Jordan
Nuclear Reactor Theory 0302750
Review Test

Dr. Saed Dababneh *March 8th, 2009*

This is a REVIEW TEST of the material that is assumed to be introductory to the course.

Question 1

a) Use the table of atomic weights and isotopic compositions to calculate the atomic weight of natural uranium.
b) The complete combustion of 1 kg of coal releases about $3x10^7$ J in heat energy. The conversion of 1 g of mass into energy is equivalent to the burning of how much coal?
c) The fission of one ^{235}U nucleus releases approximately 200 MeV. How much energy in kilowatt-hours and megawatt-days is released when one gram of ^{235}U undergoes fission?

Question 2

A beam of 2 MeV neutrons is incident on a slab of heavy water (1.105 g/cm^3). The total cross sections of deuterium and oxygen at this energy are 2.6 b and 1.6 b, respectively.
a) What is the macroscopic total cross section of heavy water at 2 MeV?
b) How thick must the slab be in order to reduce the intensity of the incident beam by a factor of 10?
c) If an incident neutron has a collision in the slab, what is the relative probability that it collides with deuterium?

Question 3

a) A neutron of energy 1 MeV is elastically scattered through an angle of 45° in a collision with a deuterium nucleus. What is the energy of the neutron and of the recoil nucleus after the scattering event?
b) How much of a change in lethargy does the neutron undergo in this collision? Compare to the average change in lethargy and to that of a head-on collision.