Problem 1. 2-7

Suppose we consider a beam of neutrons incident upon a thin target with an intensity of $10^{12}\frac{neutrons}{cm^2 s}$. Suppose further that the total cross section for the nuclei in this target is $4b$. Using this information, determine how long one would have to wait, on the average, for a given nucleus in the target to suffer a neutron interaction.

Solution

Problem 2. 2-11

Using the data from BNL-325, compute the mean free paths of neutrons with the following energies in the specified materials:

(a) $14MeV$ neutrons in air, water, and uranium (characteristic of thermonuclear fusion neutrons),

(b) $1MeV$ neutrons in air, water, and uranium (fast breeder reactor neutrons), and

(c) $0.05eV$ neutrons in air, water, and uranium (thermal reactor neutrons).

Solution

Problem 3. 2-12

Determine the kineteic energy at which the wavelength of a neutron is comparable to:

(a) the diameter of a nucleus,

(b) an atomic diameter,

(c) the interatomic spacing in graphite, and

(d) the diameter of a nuclear reactor core.

(Only rough estimates are required.)

Solution

Problem 4. 2-15

Using the Maxwell-Boltzman distribution $M(V, T)$, calculate the most probable energy of the nuclei characterized by such a distribution. Also calculate the average thermal energy of these nuclei.

Solution

Problem 5. 2-20

Determine the fission-rate density necessary to produce a thermal power density of $400kW/liter$ (typical of a fast breeder reactor core). Assume that the principle fissile isotope is $^{239}_{94}$Pu.

Solution