Problem 1. Anderson 5.9

A narrow beam of gamma rays passes through 2.0 cm of lead. The incident beam consists of 30% 0.4 MeV photons and 70% 1.5 MeV photons. What fraction of the incident fluence is transmitted? Use Figure 5.5.

In addition to what's asked for in the question, find the effective attenuation coefficient.

Solution

Problem 2. Anderson 5.10

A narrow beam of neutrons passes through 2.0 cm of cadmium. The incident beam consists of 60% 0.02 MeV neutrons and 40% 0.5 MeV neutrons. What fraction of the incident fluence is transmitted? Use the information on Figure 5.6.

Solution

Problem 3. Anderson 5.14

Calculate the dose for a 100 R exposure measured in muscle tissue and bone at 18 keV ($\mathrm{Mo} - \mathrm{K}_\alpha$), 140 keV ($^{99m}\mathrm{Tc}$), and 1.25 MeV ($^{60}\mathrm{Co}$) from the information on Figure 5.14. Assume that electronic equilibrium holds at the point of consideration.

Solution

Problem 4.

Calculate the flux of epithermal neutrons needed to deliver a dose rate of $0.1\,\mathrm{Gy\,s^{-1}}$ to muscle (tissue). Use an energy of $0.1\,\mathrm{MeV}$ to represent the average energy of epithermal neutrons.

Solution

Problem 5. Anderson 6.4

What is the angle of scatter and the energy of a Compton electron when the incident photon energy is 140 keV and the angle of scatter of the photon is 60°?

Solution

Problem 6.

Calculate the Compton edge energies (max scattered electron energy) for the following isotopes:

(a) ^{54}Mn

(b) ^{137}Cs

(c) ^{22}Na (ignore the positron annihilation gammas)

Solution

Problem 7.

Using the photon energy from a ^{137}Cs decay, calculate the following:

(a) The Klein Nishina total scattering cross section

(b) The total atomic cross section for Compton scattering in lead

(c) The Compton scattering attenuation coefficient in lead

Solution

Please see attached code

Part (a)

$$\sigma_{KN} = \pi r_0^2 \left[\frac{2\left(1+\alpha\right)}{\alpha^2} \left(\frac{2\left(1+\alpha\right)}{1+2\alpha} - \frac{ln\left(1+2\alpha\right)}{\alpha} \right) + \frac{\ln\left(1+2\alpha\right)}{\alpha} - \frac{2\left(1+3\alpha\right)}{\left(1+2\alpha\right)^2} \right]$$
$$\sigma_{KN} = 0.256\,\mathrm{b}$$

Part (b)

$$\sigma_{compton} = Z\sigma_{KN}$$
$$\sigma_{compton} = 21\,\mathrm{b}$$

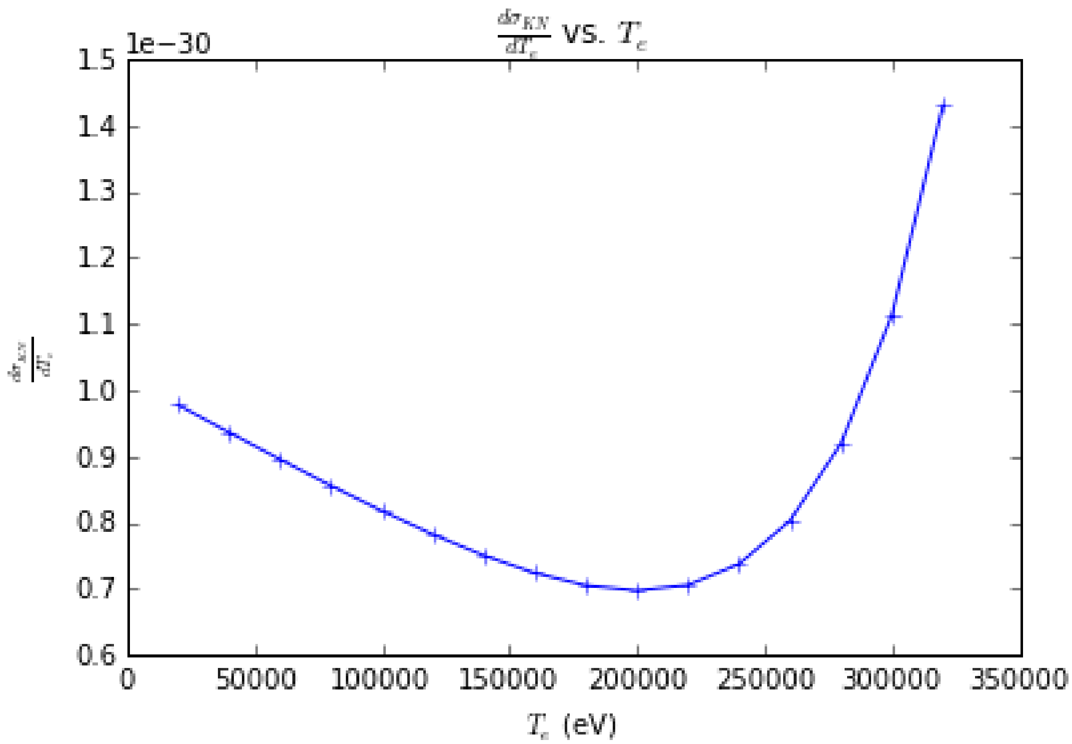
Part (c)

$$\left(\frac{\mu}{\rho}\right)_{is} = n_m \sigma_{is}$$
$$\mu_{is} = \frac{N_A Z}{M_m} \rho \sigma_{is}$$
$$\mu_{is} = 56.78\,\mathrm{cm}^{-1}$$

Problem 8.

Calculate the values for $\frac{\mathrm{d}\sigma_{KN}}{\mathrm{d}T_e}$ versus T_e assuming an incoming photon energy of 0.5 MeV. Calculate the values between $T_e = 0$ and $T_e = T_{max}$ in step sizes of 0.02 MeV. Plot your results and compare with figure 6.7

Solution



This strongly resembles figure 6.7, though without the vertical edge drawn in.