1. (J & C 5.15) A 10 MeV photon interacts in a pair process. Calculate the energy of the positron if the electron emerges from the interaction with energy of 2.0 MeV.

2. (J & C 5.18) The pair process in lead has a cross section of \(12.4 \times 10^{-28} \text{ m}^2/\text{atom}\) at 10 MeV. Find the energy converted into kinetic energy of charged particles when a beam containing \(10^4\) photons passes through a block of lead of thickness 1 cm. Assume only pair interactions.

3. (J & C 5.21) At photon energy of 5 MeV in lead, coherent, Compton, photoelectric, and pair processes all occur. The cross sections in m²/atom are given in columns 2, 3, 4, and 5 of Table A-4i. \(10^6\) photons each with energy 5 MeV pass through a foil of lead of thickness \(10^{21}\) atom/cm². Find the number of coherent, Compton, photoelectric, and pair processes. Find the mean energy converted to kinetic energy by each process and so determine the mean energy transferred for all processes. Compare with the value in the table.

4. (J & C 6.19) From Figure 6-7 determine the number of positrons set in motion with energies between 2.0 and 2.5 MeV when a beam of \(10^6\) photons of energy 20 MeV impinges on a foil of lead of thickness 0.10 g/cm².

5. (J & C 6.20) A slab of carbon 2 cm thick (density 2.25 g/cm³) is bombarded by \(10^6\) photons, each with energy of 20 MeV. Use data from Table A-4b to determine the following:

   - Number of Compton interactions
   - Energy converted to kinetic energy by Compton interactions
   - Energy scattered by the Compton process
   - Number of pair and triplet processes
   - Energy radiated as bremsstrahlung
   - Total energy diverted from the beam
   - Total energy converted to kinetic energy
   - Total energy radiated.

Make an energy balance. Calculate the energy absorbed using \(\mu_{ab}/\rho\) and compare with the energy converted to kinetic energy.