Chapter 7
Short answer question

This question is about a chest x-ray where a photographic film receives photons which have travelled through flesh and bone from a source.

(a) Explain why, although photons strike a particular place on the film 'randomly', a clear picture is built up.

(b) Accelerated electrons colliding with a target produce the x-ray photons.
Show that to produce an x-ray, quantum energy of 10^{-15} J electrons must be accelerated through a potential difference of about 6 kV.

(c) Suppose that on average 10 x-ray photons fall on each grain of the photographic film and the grains are about 1 μm across.

1. Estimate the area of a film, which covers the chest of a patient.

2. Use your estimate to estimate the total x-ray energy falling on the film.

(d) When all possible photon paths are summed, the amplitude for paths travelling through flesh is four times the size of the amplitude for paths travelling through bone.

Calculate the ratio: $\frac{\text{Probability of arrival through flesh}}{\text{Probability of arrival through bone}}$