L4   X-Rays

L4.1   a) Give a typical energy of an X-ray photon in electronvolts (eV).

   b) What accelerating voltage would be required to produce an electron of the same kinetic energy?

   c) Give the name of the process by which electrons are freed from the heated cathode.

L4.2   a) Sketch the X-ray spectrum produced by a typical X-ray machine (give a graph of intensity vs frequency) with no filtering.

   b) In a different colour, add to your sketch the spectrum expected from the same machine if the accelerating voltage were doubled.

L4.3   What is the predominant process occurring when 100 keV electrons interact with atoms?

L4.4   How is the **Compton effect** different from the **photoelectric effect**? After all, they both free an electron from an atom…

L4.5   Often, a thin metal filter is placed between the X-ray machine and the patient. Why?

L4.6   High energy X-rays can be used for radiotherapy (cancer treatment), as they have the same frequencies as gamma rays.

   a) Why are they still called X-rays even though they have the same frequency as a gamma ray?

   b) Why do medical professionals often prefer to use these high energy X-rays rather than 'real' gamma rays?

L4.7   Give three differences between a conventional X-ray and a CAT scan.

L4.8   Draw a diagram to show how the use of a lead grid can improve the quality of an X-ray image.

L4.9   Name a contrast medium used with conventional X-rays to assist in the imaging of tissue which would not usually show up on an X-ray.

L4.10   a) Define **intensity**, and give its unit.

   b) Define the **attenuation coefficient** μ, and give its unit.

   c) Give a typical value for μ for bone.