8 **(a)** State what is meant by a photon.

.....

.....

..... [2]

(b) Fig. 8.1 shows a tube in which X-rays are produced at a metal target.

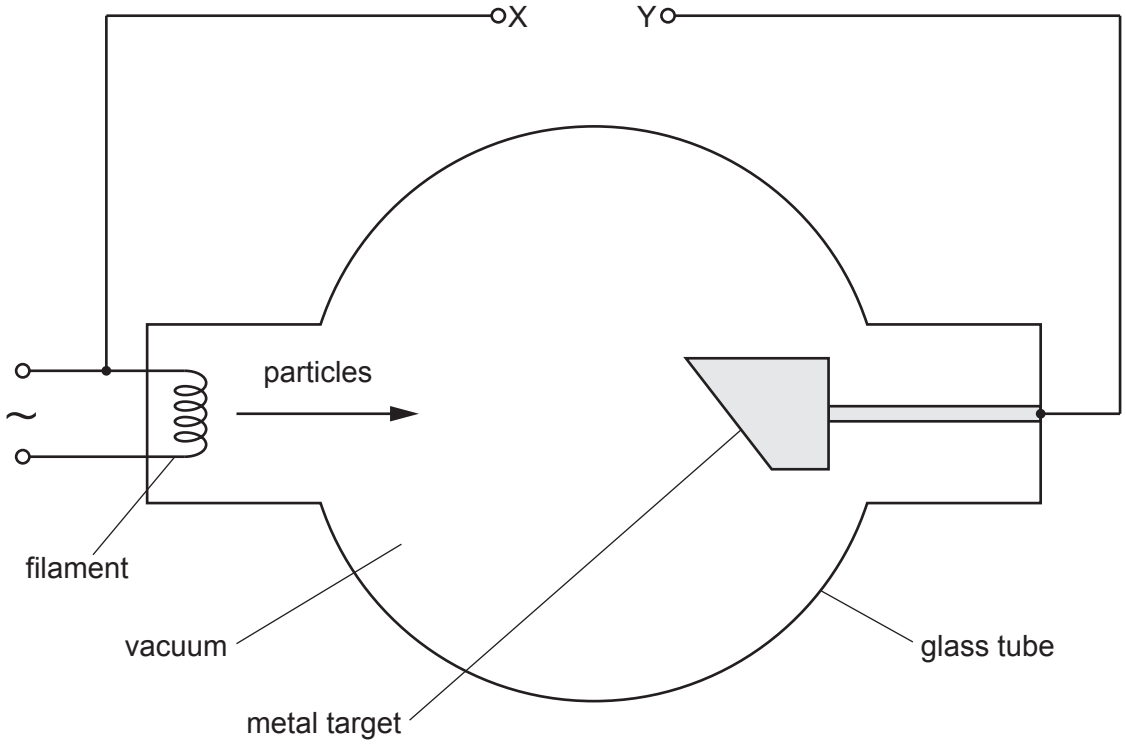

Fig. 8.1

Particles are accelerated from the filament to the target by a constant high voltage applied across the terminals X and Y.

(i) State the name of the particles.

..... [1]

(ii) On Fig. 8.1, use + and – signs to label terminals X and Y to indicate the polarity of the high voltage. [1]

(c) For an accelerating voltage of 32 kV in Fig. 8.1, determine:

(i) the maximum energy, in MeV, of an X-ray photon produced at the target

maximum photon energy = ... MeV [1]

(ii) the maximum momentum of an X-ray photon produced at the target

maximum photon momentum = ... Ns [2]

(iii) the minimum wavelength of X-rays produced at the target.

minimum wavelength = ... m [3]

(d) Explain why X-rays can be used to produce images of internal body structures that have good contrast.

.....

.....

.....

.....

..... [3]

[Total: 12]