6 Fig 6.1 below shows how x-rays are produced inside an x-ray tube. The electrons emitted at the cathode are accelerated from rest using an accelerating voltage to hit a target made of a metal at the anode and produce x-rays as a result.

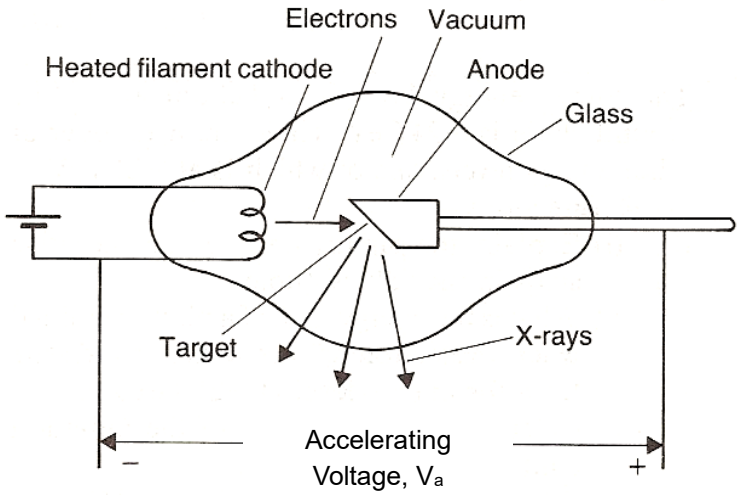

Fig. 6.1

A graph of relative intensity against wavelength of the emitted radiation shows an emission line spectrum superimposed on a continuous spectrum as shown in Fig. 6.2.

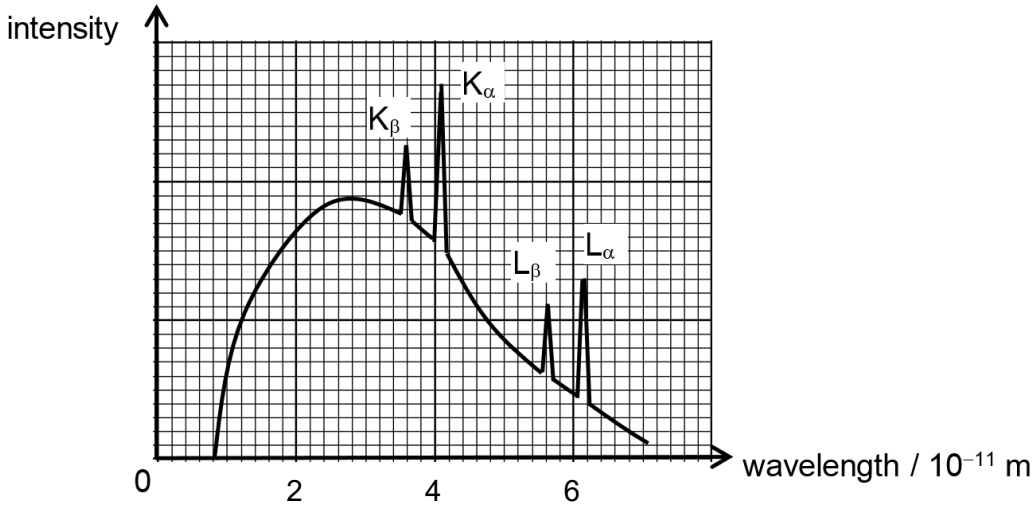

Fig. 6.2

(a) Explain how the characteristic X-ray lines and continuous spectrum are produced in Fig. 6.2.

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[3]

(b) **(i)** Determine the maximum energy of the x-ray photons emitted.

maximum energy= …….. J

[2]

(ii) Show that the accelerating voltage V_a used is 155 kV.

[1]

(iii) Calculate the speed at which the electrons hit the target when the accelerating voltage is 155 kV.

[2]

velocity of electron = …… m s^{-1}

(c) By using your answer in **(b)(iii)**, make a suitable calculation to suggest why the *wave properties* of electrons are not observable in this experiment.

[2]

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[Total: 10]