6 **(a)** To produce X-rays, a metal target inside an X-ray tube is bombarded with high speed electrons that have been accelerated over a large potential difference.

Fig. 6.1 shows the variation with wavelength of the emitted radiation from the tube of the X-ray intensity. It consists of a continuous spectrum with two sharp peaks, labelled K_α and K_β. The X-ray spectrum cuts off at a minimum wavelength of λ_0.

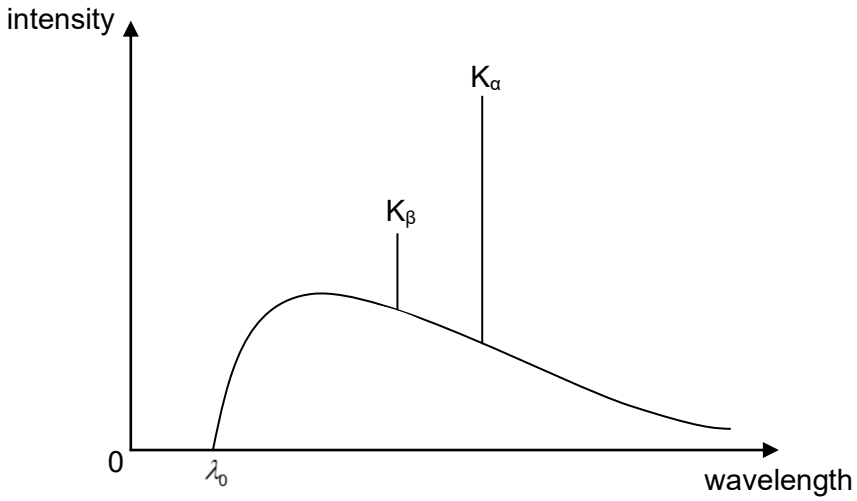

Fig. 6.1

(i) Explain the formation of the continuous spectrum.

.....

.....

.....

.....

.....

..... [3]

(ii) Determine λ_0 if the electrons are accelerated over a potential difference of 50 kV.

λ_0 = ... m [2]

(iii) Besides the K_α and K_β peaks, two other peaks L_α and L_β can also be observed on the X-ray spectrum in Fig 6.1.

The L_α and L_β peaks are due to photons produced from electronic transitions within the metal atoms from energy levels n = 3 to n = 2, and n = 4 to n = 2 respectively.

Sketch the L_α and L_β peaks on Fig. 6.1. Label the two peaks clearly. [2]

(b) In a photoelectric experiment, a metal target in a vacuum tube is bombarded with electromagnetic radiation.

Fig. 6.2 shows the variation with the frequency f of the incident radiation of the stopping potential V_S.

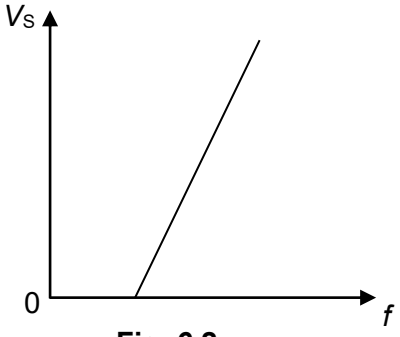

Fig. 6.2

(i) Determine, with clear explanations, the gradient of the graph.

gradient = ... [2]

(ii) When potassium was used as the metal target, it was found that no photocurrent was generated when the frequency of the incident electromagnetic radiation was below 5.55×10^{14} Hz.

Determine the work function energy of potassium.

work function energy = ... eV [2]

(iii) On Fig. 6.2, sketch a graph to represent the variation with f of V_S if tungsten was used as the metal target instead. The work function energy of tungsten is 4.50 eV.

[1]

End Section A
Section B

Answer **one** question from this Section in the spaces provided.