7 **(a)** Fig. 7.1 shows some spectral lines emitted from a discharge tube filled with low pressure mercury vapour.

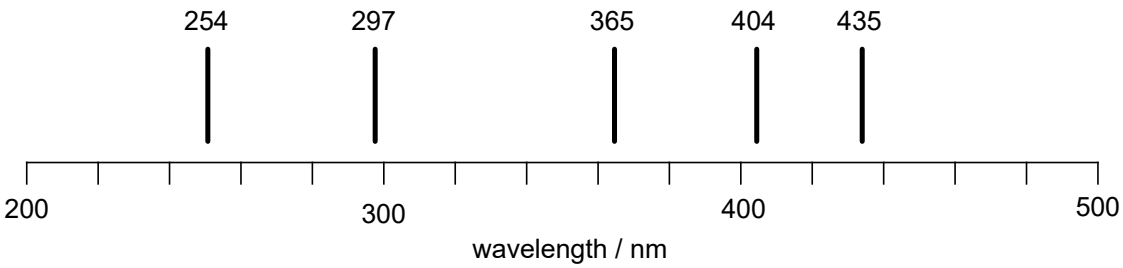

Fig. 7.1

Explain how the line spectrum of atoms, such as those shown in Fig. 7.1, provides evidence for the existence of discrete electron energy levels.

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…… [3]

(b) The photons emitted from the discharge tube in **(a)** are incident on a metal surface in a vacuum tube, as shown in Fig. 7.2.

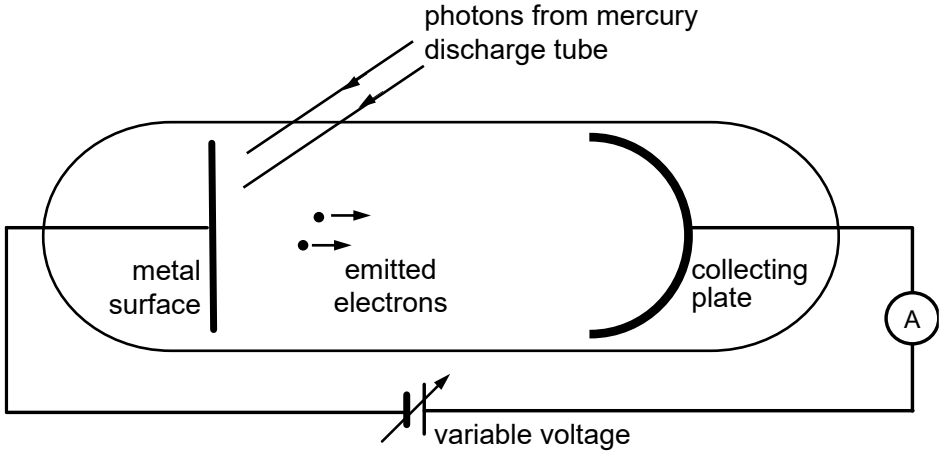

Fig. 7.2

The metal surface that has a work function of 3.2 eV.
Electrons are emitted from the metal surface.

Photons from the mercury discharge tube corresponding to the shortest wavelength of 254 nm cause emission of electrons from the metal surface with different kinetic energies.

(i) Explain why the electrons are emitted with different kinetic energies.

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…… [3]

(ii) **1.** Deduce the other wavelengths from the mercury discharge tube that can also cause emission of electrons.

wavelengths …… [2]

2. Explain whether your answer to **(b)(ii)1.** is affected by the intensity of the electromagnetic radiation from the mercury discharge tube.

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…… [2]

[Total: 10]

Section B

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