6 A photocell is connected in a series circuit with a variable d.c. power supply and a sensitive ammeter as shown in Fig. 6.1.

The photocell is illuminated with electromagnetic radiation of wavelength 264 nm and power 3.8 mW and photoelectrons are emitted. The potential difference *V* between the collector C and emitter E in the photocell is adjusted and the photocurrent *I* is measured. Fig. 6.2 below shows the graph of *I* against *V*.

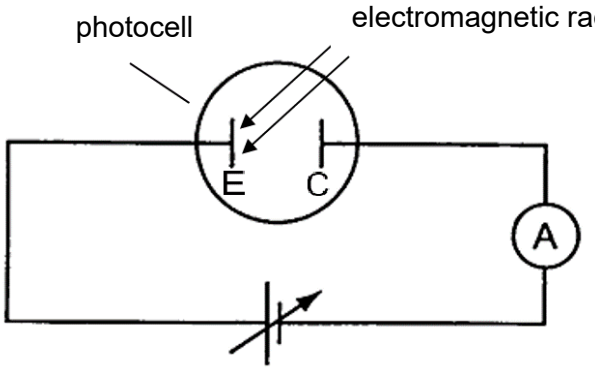

Fig. 6.1

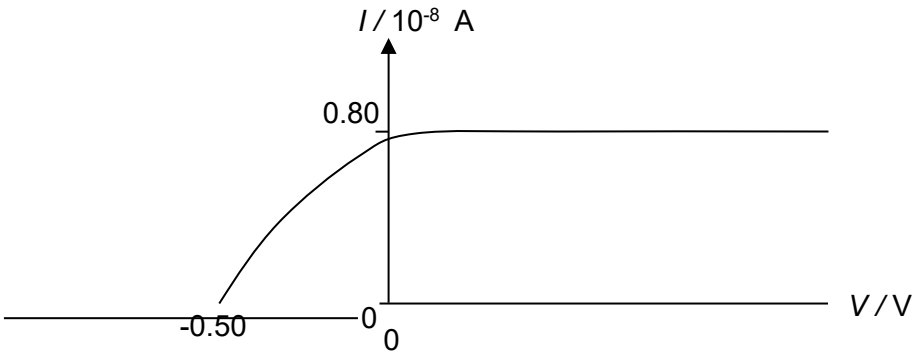

Fig. 6.2

(a) Explain why the photocurrent does not continue to increase for positive values of *V*.

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…… [1]

(b) **(i)** Determine the energy of a photon of the incident electromagnetic radiation.

energy = ……. J [1]

(ii) Calculate the rate at which the photons are incident on the emitter.

rate of photon incidence = ……. s^{-1} [2]

(iii) Show that the maximum rate of photoelectron emission is 5.0×10^{10} s^{-1}.

[1]

(iv) Suggest a reason for the difference between **(b)(ii)** and your answer in **(b)(iii)**.

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……..……
……. [1]

(c) **(i)** Calculate the work function energy of the emitter.

work function energy = …… J [1]

(ii) The emitter is replaced with another emitter of **half** the work function energy. On Fig. 6.2, sketch a graph to show the new variation with V of I. [2]