6 (a) Use the theory of the particulate nature of electromagnetic radiation to explain why there is a threshold frequency for the photoelectric effect.

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.....[3]

(b) An experimental setup to investigate the photoelectric effect is shown in Fig. 6.1. Electromagnetic radiation is incident on the emitter E of the photocell and the photoelectrons move towards the collector C.

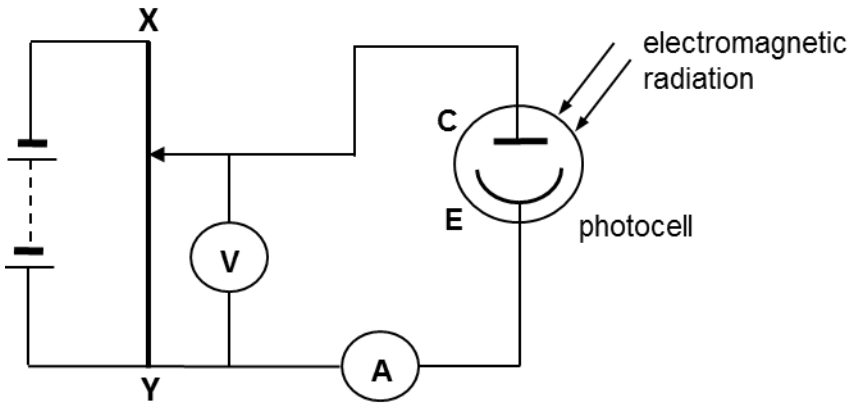

Fig. 6.1

The wavelength of the electromagnetic radiation incident on the photocell was varied. For two values of wavelength λ, the stopping potential V_S required for the ammeter reading to become zero was measured. The results are shown in Fig. 6.2.

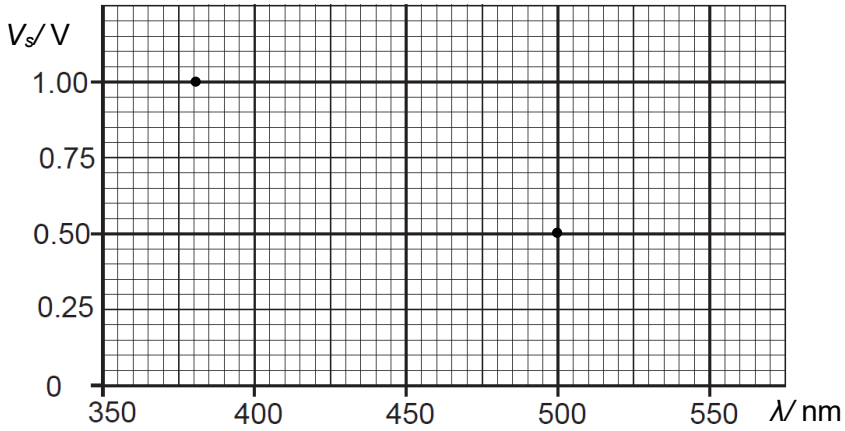

Fig. 6.2

[Turn over

(i) Calculate the maximum kinetic energy of a photoelectron emitted from the metal surface by radiation of wavelength 500 nm.

maximum kinetic energy = …… J [2]

(ii) Calculate the energy of a photon of wavelength 500 nm.

energy = …… J [2]

(iii) Hence, determine

1. the work function energy of the metal surface, and

work function energy = …… J [1]

2. the maximum photon wavelength that can liberate a photoelectron.

maximum wavelength = …….. nm [2]

(iv) Suggest why it is not possible to deduce the maximum photon wavelength that can liberate a photoelectron from this metal plate directly from the data in Fig. 6.2.

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