

- 6 (a) With reference to the photoelectric effect, explain why the existence of a threshold frequency provides evidence for the particulate nature of electromagnetic radiation.

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[3]

- (b) Light of frequency  $f$  and wavelength  $\lambda$  is incident on a metal surface with work function energy  $\phi$ . Electrons are emitted from the surface with maximum kinetic energy  $E_{\max}$ .

The variation of  $E_{\max}\lambda$  with  $\lambda$  from 100 nm to 1000 nm is shown in Fig. 6.1.

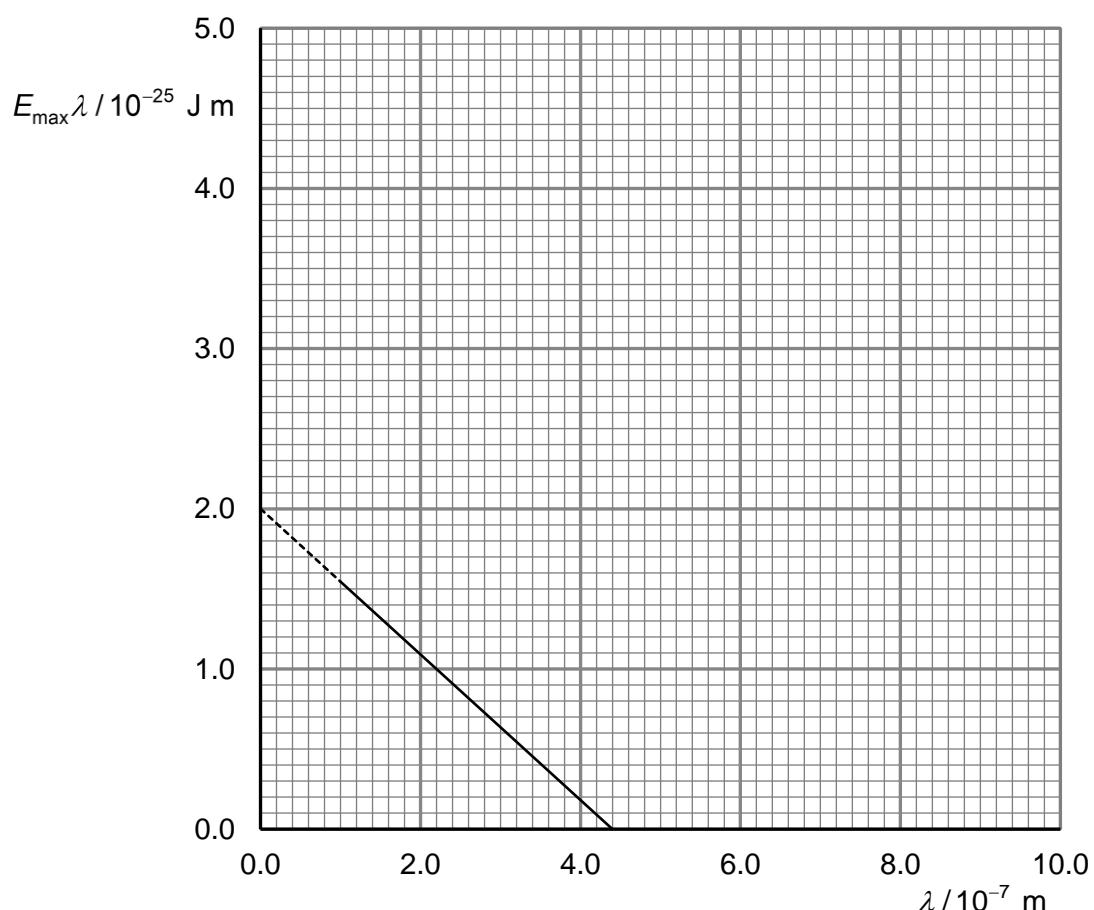


Fig. 6.1

- (i) Use Fig. 6.1 to determine  $\phi$ . Explain your working.

$$\phi = \dots \text{ J} \quad [2]$$

- (ii) For  $\lambda = 2.0 \times 10^{-7} \text{ m}$ , use Fig. 6.1 to determine

1. the stopping potential,

$$\text{stopping potential} = \dots \text{ V} \quad [3]$$

2. the de Broglie wavelength of the electron with maximum kinetic energy.

$$\text{wavelength} = \dots \text{ m} \quad [2]$$

- (c) The metal is now replaced with another metal with twice the work function energy.

On Fig. 6.1, draw a line to show the variation of  $E_{\max}\lambda$  with  $\lambda$  for this new metal.

[2]

**End of Paper 3 Section A**