

- 7 (a) A beam of white light, consisting of wavelengths between 400 nm and 700 nm, is incident on a cool sodium gas at low pressure. Fig. 7.1 shows the four lowest energy levels of the sodium atom.

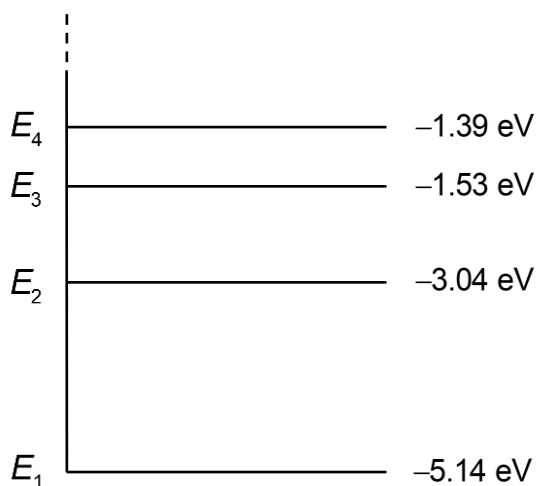


Fig. 7.1

- (i) An absorption spectrum is a continuous bright spectrum with discrete dark lines superimposed on it. Although the photons that are absorbed by the cool gas are re-emitted, dark lines are still observed.

Explain why dark lines are observed even when photons are emitted.

.....
 [1]

- (ii) Use Fig. 7.1 to determine the number of absorption spectral lines that are observed.

Show your working.

number of observable lines = [3]

- (b) X-ray photons are produced when electrons are accelerated through a large potential difference towards a metal target. An X-ray spectrum is shown in Fig. 7.2.

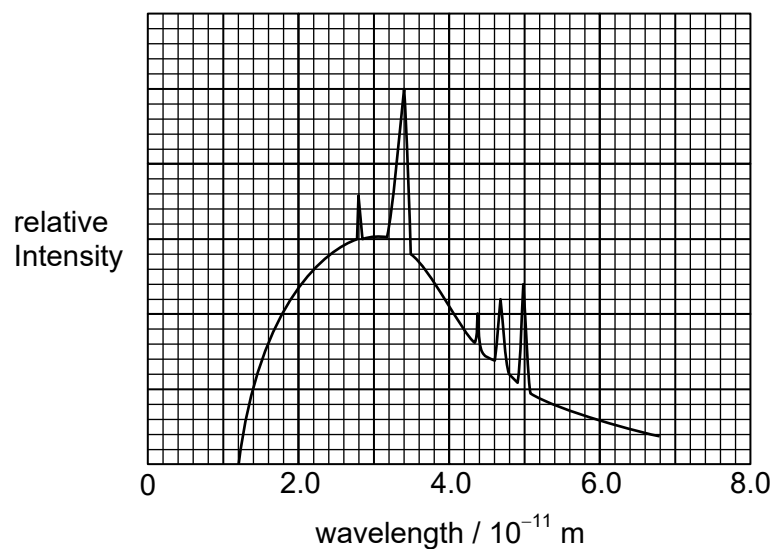


Fig. 7.2

- (i) Explain how the most energetic X-ray photons are produced.

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 [2]

- (ii) Determine the momentum of the X-ray photon with the highest relative intensity.

momentum = kg m s^{-1} [1]

- (iii) The potential difference used to accelerate the electrons is increased.

On Fig. 7.2, sketch the new spectrum obtained.

[1]