

- 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.

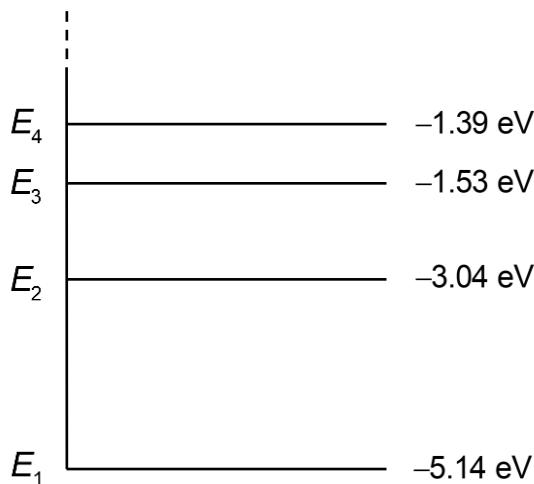


Fig. 7.1

- (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.

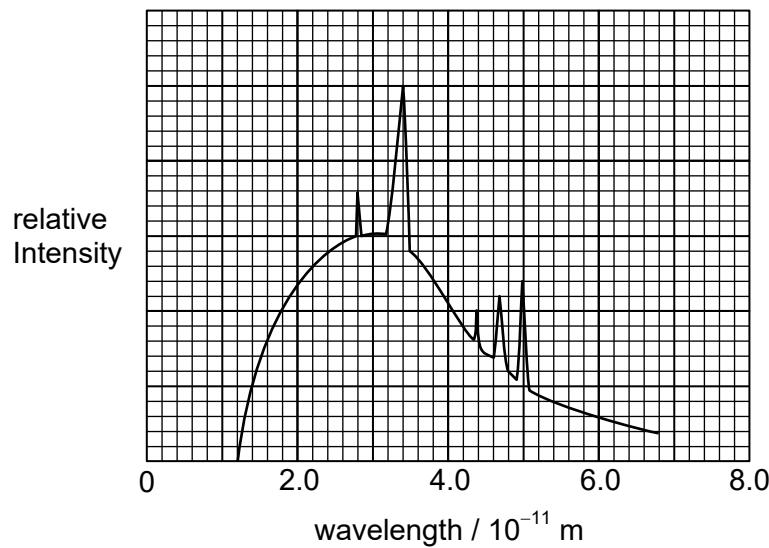


Fig. 7.2

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

.....
.....
.....
.....

[2]

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

$$\text{momentum} = \dots \text{kg m s}^{-1}$$

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

On Fig. 7.2, sketch the new spectrum obtained.

[1]