

Past-paper walk-through

Energy levels in atoms and line spectra ■ 22.4

eXercise

Questions in this set

- 9702/42 N25 Q8 ■ 10 marks
- 9702/42 J24 Q8 ■ 12 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 8

9702/42 N25 ■ Q8 ■ 10 marks

Fig. 8.1 shows the three lowest-frequency lines in the part of the emission spectrum for hydrogen that relates to electron transitions to the ground state (level $n = 1$).

The numbers represent the frequencies, in 10^{15} Hz, associated with the spectral lines.

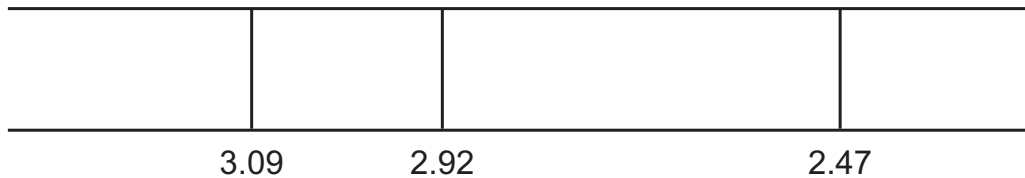
(a) Use the photon model of electromagnetic radiation to explain how the existence of spectral lines in the emission spectrum provides evidence for discrete electron energy levels in the hydrogen atom.

[3]

Question 8

level	(energy difference from $n = 1$)/eV	energy/eV
$n = 4$		
$n = 3$		
$n = 2$	10.2	
$n = 1$	0.0	-13.6

Question 8



Question 8

9702/42 N25 ■ Q8 ■ 10 marks

Fig. 8.1 shows the three lowest-frequency lines in the part of the emission spectrum for hydrogen that relates to electron transitions to the ground state (level $n = 1$).

The numbers represent the frequencies, in 10^{15} Hz, associated with the spectral lines.

(b)(i) Calculate the energy, in J, of the ground state.

[1]

(b)(ii) Show that the energy difference between levels $n = 1$ and $n = 2$ is 10.2 eV.

[2]

(b)(iii) Complete Table 8.1 to show the energy differences from the ground state, and the energies of the levels up to $n = 4$, in the hydrogen atom. Use the space for any working.

Table 8.1