

- 7 Fig. 7.1 shows the lowest four energy levels of an electron in an isolated atom.

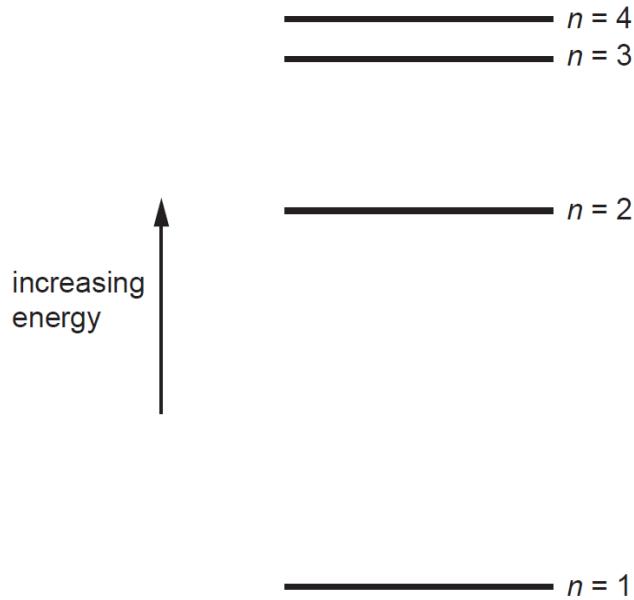


Fig. 7.1 (drawn to scale)

Fig. 7.2 shows the lines in the emission spectrum of the atom that correspond to the transitions of the electron from $n = 3$ to $n = 1$ and from $n = 4$ to $n = 1$.

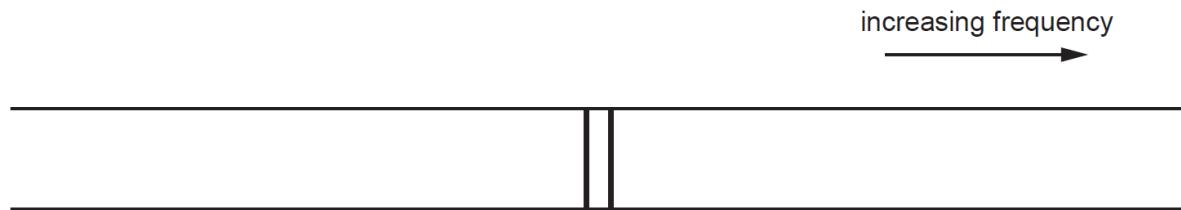


Fig. 7.2

- (a) Explain, with reference to photons, why there is a single frequency of electromagnetic radiation that corresponds to each of these transitions.

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[2]

- (b) (i) On Fig. 7.2, draw a line that corresponds to the transition of the electron from $n = 2$ to $n = 1$.

Label this line A.

[1]

- (ii) On Fig. 7.2, draw a line that corresponds to the transition of the electron from $n = 3$ to $n = 2$.

Label this line B.

[1]

- (c) The frequency of radiation represented by line A is f_A .
The frequency of radiation represented by line B is f_B .
The energy of the ground state ($n = 1$) is E_1 .

Determine an expression, in terms of f_A , f_B , E_1 and the Planck constant h , for the energy E_3 of the energy level $n = 3$.

$$E_3 = \dots [2]$$