

12 (a) State an effect, one in each case, that provides evidence for

- (i) the wave nature of a particle,

..... [1]

- (ii) the particulate nature of electromagnetic radiation.

..... [1]

(b) Four electron energy levels in an isolated atom are shown in Fig. 12.1.

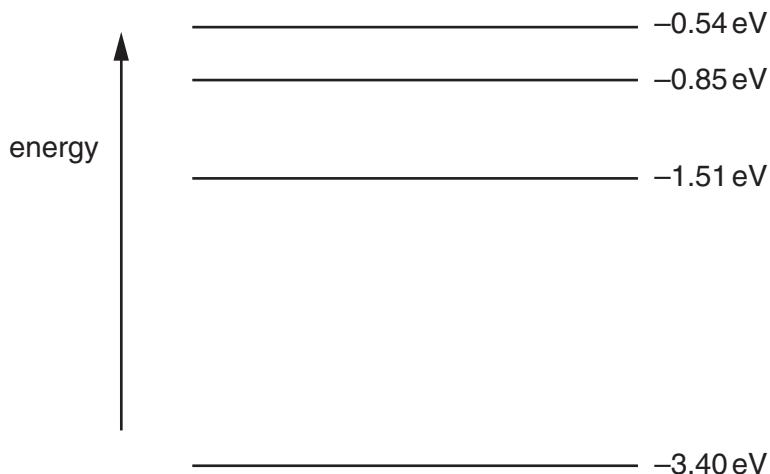


Fig. 12.1

For the emission spectrum associated with these energy levels,

- (i) on Fig. 12.1, mark with an arrow the transition that gives rise to the shortest wavelength, [1]

- (ii) show that the wavelength of the transition in (i) is 4.35×10^{-7} m.

[2]

- (c) (i) State what is meant by the *de Broglie wavelength*.

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

[2]

- (ii) Calculate the speed of an electron having a de Broglie wavelength equal to the wavelength in (b)(ii).

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

[Total: 9]