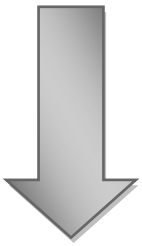
Problem-Solving Example 10

Lyman series of the hydrogen atom, a line emission spectrum has a frequency of 3.09×10^{15} Hz. Determine the energy levels of this electron transition.

Solution



Example 10 : Solution :

For Lyman Series, $n_x = 1$; $n_y = ?$

$$\lambda = \frac{c}{\nu} = \frac{2.998 \times 10^{8} ms^{-1}}{3.09 \times 10^{15} Hz} = 9.70 \times 10^{-8} m$$

$$\bar{\nu} = \frac{1}{\lambda} = \left(\frac{1}{9.70 \times 10^{-8}}\right) m^{-1} = 1.03 \times 10^{7} m^{-1} = 1.03 \times 10^{5} cm^{-1}$$

$$\bar{\nu} = (109678\ cm^{-1})\left(\frac{1}{n_x^2} - \frac{1}{n_y^2}\right)$$

$$1.03 \times 10^{5}\ cm^{-1} = 109678\ cm^{-1}\left(\frac{1}{1^2} - \frac{1}{n_y^2}\right)$$

$$1 - \frac{1}{n_y^2} = 0.939$$

$$n_y = 4$$

Thus, the electron move from $n = 4$ to $n = 1$.

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