

Exemplar Problems

Q. 32 The Balmer series in the hydrogen spectrum corresponds to the transition from $n_1 = 2$ to $n_2 = 3, 4, \dots$. This series lies in the visible region. Calculate the wave number of line associated with the transition in Balmer series when the electron moves to $n = 4$ orbit.
($R_H = 109677 \text{ cm}^{-1}$)

Ans. From Rydberg formula,

$$\text{Wave number, } \quad \bar{\nu} = 109677 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right] \text{ cm}^{-1}$$

Given, $n_1 = 2$ and $n_2 = 4$ (Transition in Balmer series)

$$\bar{\nu} = 109677 \left[\frac{1}{2^2} - \frac{1}{4^2} \right] \text{ cm}^{-1}$$

$$\Rightarrow \quad \bar{\nu} = 109677 \left[\frac{1}{4} - \frac{1}{16} \right] \text{ cm}^{-1}$$

$$\Rightarrow \quad \bar{\nu} = 109677 \times \left[\frac{4-1}{16} \right] \text{ cm}^{-1}$$

$$\Rightarrow \quad \bar{\nu} = 20564.44 \text{ cm}^{-1}$$