Problem-Solving Example 9

Calculate spectrum serial limit (in m^{-1} unit) for Lyman, Balmer and Paschen siries.

Solution

Problem-solving Example 9 Solution :

Serial limit for emission spectrum is when $n_y = \infty$

For Lyman Series, $n_x = 1$

$$\bar{\nu} = 109\,678\ \text{cm}^{-1}\left[\frac{1}{n_x^2} - \frac{1}{n_y^2}\right] \quad \because n_x < n_y$$

$$\bar{\nu}_{(\infty \to 1)} = 109\,678\ \text{cm}^{-1}\left(\frac{1}{1^2} - \frac{1}{\infty^2}\right)$$

$$= 109\,678\ \text{cm}^{-1}$$

$$\bar{\nu} = 109\,678\,00\ \text{m}^{-1} = 1.1 \times 10^7\ \text{m}^{-1}$$

So, Spectrum serial limit of Lyman Series is $1 \times 10^7\ \text{m}^{-1}$

For Balmer Series, $n_x = 2$

$$\bar{\nu}_{(\infty \to 2)} = 109\,678\ \text{cm}^{-1}\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right)$$

$$\therefore \bar{\nu} = \left(\frac{109\,678}{4}\right) \times 10^2\ \text{m}^{-1} = 2.74 \times 10^6\ \text{m}^{-1}$$

So, Spectrum serial limit of Balmer Series is $2.74 \times 10^6\ \text{m}^{-1}$.

For Paschen Series, $n_x = 3$

$$\bar{\nu}_{(\infty \to 3)} = 109\,678\ \text{cm}^{-1}\left(\frac{1}{3^2} - \frac{1}{\infty^2}\right)$$

$$= \left(\frac{109\,678 \times 10^2}{9}\right)\text{m}^{-1}$$

$$= 1.22 \times 10^6\ \text{m}^{-1}$$

So, Spectrum serial limit of Paschen Series is $1.22 \times 10^6\ \text{m}^{-1}$.

Prepared by
V.Manoharan
vmano@usm.my
manovv1955@yahoo.com
04-6533888 ext 3566