

Problema204: Calcula a frecuencia e lonxitude de onda das dúas primeiras liñas da serie de Lyman do espectro do hidróxeno. $R_H = 1,097 \cdot 10^7 m^{-1}$.

Fórmula de Rydberg

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \right]$$

Para a serie de Lyman

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{1^2} - \frac{1}{n_2^2} \right) \right]$$

a) Primeira liña de Lyman

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{1^2} - \frac{1}{2^2} \right) \right]$$

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{1^2} - \frac{1}{2^2} \right) \right] = 1,097 \cdot 10^7 m^{-1} \left[\left(\frac{1}{1} - \frac{1}{4} \right) \right] = 1,097 \cdot 10^7 m^{-1} \cdot \frac{3}{4} = 8,228 \cdot 10^6 m^{-1}$$

$$\lambda = \frac{1}{8,228 \cdot 10^6 m^{-1}} = \underline{1,22 \cdot 10^{-7} m = 122 nm}$$

$$c = \lambda \cdot f$$

$$f = \frac{c}{\lambda} = \frac{3 \cdot 10^8 m/s}{1,22 \cdot 10^{-7} m} = \underline{2,46 \cdot 10^{15} s^{-1} = 2,46 \cdot 10^{15} Hz}$$

b) Segunda liña de Lyman

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{1^2} - \frac{1}{3^2} \right) \right]$$

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{1^2} - \frac{1}{3^2} \right) \right] = 1,097 \cdot 10^7 m^{-1} \left[\left(\frac{1}{1} - \frac{1}{9} \right) \right] = 1,097 \cdot 10^7 m^{-1} \cdot \frac{8}{9} = 9,751 \cdot 10^6 m^{-1}$$

$$\lambda = \frac{1}{9,751 \cdot 10^6 m^{-1}} = \underline{1,03 \cdot 10^{-7} m = 103 nm}$$

$$c = \lambda \cdot f$$

$$f = \frac{c}{\lambda} = \frac{3 \cdot 10^8 m/s}{1,03 \cdot 10^{-7} m} = \underline{2,91 \cdot 10^{15} s^{-1} = 2,91 \cdot 10^{15} Hz}$$