

Problema203: Calcula a frecuencia e lonxitude de onda das dúas primeiras liñas da serie de Balmer 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 Balmer

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

a) Primeira liña de Balmer

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

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{2^2} - \frac{1}{3^2} \right) \right] = 1,097 \cdot 10^7 m^{-1} \left[\left(\frac{1}{4} - \frac{1}{9} \right) \right] = 1,097 \cdot 10^7 m^{-1} \cdot \frac{5}{36} = 1,524 \cdot 10^6 m^{-1}$$

$$\lambda = \frac{1}{1,524 \cdot 10^6 m^{-1}} = \underline{6,56 \cdot 10^{-7} m = 657 nm}$$

$$c = \lambda \cdot f$$

$$f = \frac{c}{\lambda} = \frac{3 \cdot 10^8 m/s}{6,56 \cdot 10^{-7} m} = \underline{4,57 \cdot 10^{14} s^{-1} = 4,57 \cdot 10^{14} Hz}$$

b) Segunda liña de Balmer

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{2^2} - \frac{1}{4^2} \right) \right]$$

$$\frac{1}{\lambda} = R_H \left[\left(\frac{1}{2^2} - \frac{1}{4^2} \right) \right] = 1,097 \cdot 10^7 m^{-1} \left[\left(\frac{1}{4} - \frac{1}{16} \right) \right] = 1,097 \cdot 10^7 m^{-1} \cdot \frac{5}{36} = 2,057 \cdot 10^6 m^{-1}$$

$$\lambda = \frac{1}{2,057 \cdot 10^6 m^{-1}} = \underline{4,86 \cdot 10^{-7} m = 486 nm}$$

$$c = \lambda \cdot f$$

$$f = \frac{c}{\lambda} = \frac{3 \cdot 10^8 m/s}{4,86 \cdot 10^{-7} m} = \underline{6,17 \cdot 10^{14} s^{-1} = 6,17 \cdot 10^{14} Hz}$$