

Problema204: Calcula la frecuencia y longitud de onda de las dos primeras líneas de la serie de Lyman del espectro del hidrógeno.  $R_H = 1,097 \cdot 10^7 \text{ m}^{-1}$ .

Fórmula de Rydberg

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

Para la serie de Lyman

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

a) Primera línea de Lyman

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

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

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

$$c = \lambda \cdot f$$

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

b) Segunda línea de Lyman

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

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

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

$$c = \lambda \cdot f$$

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