

Answer on the question #52505 – Chemistry – Physical Chemistry

Question:

Calculate the frequency, energy and wavelength of the radiation corresponding to the spectral line of lowest frequency in Lyman's series in the spectra of hydrogen atom. Also calculate the energy for the corresponding line in the spectra of Li^{2+} ($R_H = 1.09678 \cdot 10^7$, $c = 3 \cdot 10^8$)

Answer:

According to Rydberg formula:

$$\frac{1}{\lambda} = R_H \left(1 - \frac{1}{n^2}\right) = 1.09678 \cdot 10^7 \left(1 - \frac{1}{2^2}\right) = 0.8226 \cdot 10^7 \text{ m}^{-1}$$

Frequency calculation:

$$\nu = \frac{c}{\lambda} = 0.8226 \cdot 10^7 \cdot 3 \cdot 10^8 = 2.44678 \cdot 10^{15} \text{ s}^{-1}$$

Energy:

$$E = h\nu = 4.135668 \cdot 10^{-15} \cdot 2.44678 \cdot 10^{15} = 10.21 \text{ eV}$$

Wavelength:

$$\lambda = \frac{1}{0.8226 \cdot 10^7} = 121.57 \text{ nm}$$