Answer on Question #56439 - Chemistry - Other

Question:

Using Rydberg's equation for the energy levels (E = -R/n^2) and the wavelength and the c=(lambda)v, E=hv equations, SHOW/ PROVE how E(red band in H-spectrum, lambda = 656 nm) = (Delta or change/ difference) E (3 --> 2)?

Answer:

Let's calculate the energy values for the energy levels 3 and 2:

$$E_n = -\frac{R}{n^2}, \qquad E_3 = -\frac{2.178 \cdot 10^{-18}(J)}{3^2} = -2.42 \cdot 10^{-19}\ J$$

$$E_2 = -\frac{2.178 \cdot 10^{-18}\ (J)}{2^2} = -5.45 \cdot 10^{-19} J$$

Then, the difference between the energy of 3^{d} and 2nd levels is:

$$\Delta E = E_3 - E_2 = (-2.42 + 5.45) \cdot 10^{-19} = 3.03 \cdot 10^{-19}\ J$$

The wavelength, corresponding to this energy change is:

$$E = h\nu = \frac{hc}{\lambda}, \lambda = \frac{hc}{E} = \frac{6.63 \cdot 10^{-34}(J \cdot s) \cdot 3 \cdot 10^{8}(m \cdot s^{-1})}{3.03 \cdot 10^{-19}\ (J)} = 6.56 \cdot 10^{-7}\ m = 656\ nm$$