Answer on Question #45492, Physics, Atomic Physics

An electron in the n = 6 level of an H atom emits a photon of wavelength 2626 nm. To what energy level does it move?

Solution:

We use the Rydberg formula for hydrogen

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

Where λ is the wavelength of electromagnetic radiation emitted in vacuum,

R is the Rydberg constant, approximately 1.097 x 10^7 m^{-1},

n_1 and n_2 are integers greater than or equal to 1 such that $n_1 < n_2$.

In our case λ = 2626x10^{-9} m, n_2 = 6 and n_1 = ?.

$$\frac{1}{n_1^2} = \frac{1}{R\lambda} + \frac{1}{n_2^2} = \frac{1}{1.097 \cdot 10^7 \cdot 2626 \cdot 10^{-9}} + \frac{1}{6^2} = 0.0347 + \frac{1}{36} = 0.0625$$

Thus,

$$n_1^2 = \frac{1}{0.0625} = 16$$

So,

$$n_1 = 4$$

Answer: $\boldsymbol{n_1 = 4.}$