Differences between Ground State, Excited State and Ionized State

(i) When $n=1$: $E_1 = -2.18 \times 10^{-18}$ J (lowest energy : the most negative)
- known as Ground state.

(ii) When $n=2$ (Energy E_2); $n=3$ (Energy E_3); $n=4$ (Energy E_4) etc..
its energy state is known as Excited state
So. the 1st excited state, E_2 is when $n=2$,
the 2nd excited state, E_3 is when $n=3$
the 3rd excited state, E_4 is when $n=4$

(iii) When $n=\infty$ (Energy E_∞) : it's energy state is known as Ionized state
ie $H(g) \longrightarrow H^+(g) + e^-$

Problem-solving Example 15

Hydrogen atom energy when its electron is at ground state is -13.6eV. Calculate its energy at third excited state in kJ.

Solution

eV (electron volt) is a energy unit
$1eV = 1.602 \times 10^{-19}$ J

$$E_n = -\frac{e^4 m}{8\epsilon_0^2 h^2 n^2}$$

When $n=1$ (ground state): $E_1 = -13.6\,eV$
$= -13.6 \times 1.602 \times 10^{-19}$ J
$= -2.179 \times 10^{-18}$ J

3rd excited state means $n=4$:
$$E_4 = \frac{-2.179 \times 10^{-18}}{n^2}\ J$$
$$= \frac{-2.179 \times 10^{-18}}{4^2}\ J$$
$$= -1.362 \times 10^{-19}\ J \text{ (Ans)}$$

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