Answer on Question #46790 – Chemistry – Physical Chemistry

Question:

Calculate the radius of the third orbit of Li^{2+} ion. Also calculate the energy of the electron in the second orbit of Li^{2+} ion.

Answer:

The radius of the third orbit of Li^{2+} ion can be calculated from the following formula:

$$r_n = \frac{n^2 \cdot h^2 \cdot \varepsilon_0}{3 \cdot \pi \cdot e^2 \cdot m}$$

r_n – the radius of the n-th orbit, m;
n – number of the orbit;
h – Planck constant, $6.63 \cdot 10^{-34}$ J·s;
ε_0 – dielectric permittivity of vacuum, $8.85 \cdot 10^{-12}$ F/m;
e – charge of the electron, $1.6 \cdot 10^{-19}$ C;
m – mass of the electron, $9.11 \cdot 10^{-31}$ kg.

$$r_n = \frac{3^2 \cdot (6.63 \cdot 10^{-34})^2 \cdot 8.85 \cdot 10^{-12}}{3 \cdot 3.14 \cdot (1.6 \cdot 10^{-19})^2 \cdot (9.11 \cdot 10^{-31})} = 1.59 \cdot 10^{-10} m = 1.59 \text{A}^0$$

The energy of the electron in the second orbit of Li^{2+} ion can be calculated from the following formula:

$$E_n = -\frac{9 \cdot m \cdot e^4}{8 \cdot n^2 \cdot h^2 \cdot \varepsilon_0{}^2} = -\frac{9 \cdot 9.11 \cdot 10^{-31} \cdot (1.6 \cdot 10^{-19})^4}{8 \cdot 2^2 \cdot (6.63 \cdot 10^{-34})^2 \cdot (8.85 \cdot 10^{-12})^2} = -4.88 \cdot 10^{-18} J$$

Answer: The radius of the third orbit of Li^{2+} is **1.59 A^0** and **the energy** of the electron in the second orbit of Li^{2+} is **$-4.88 \cdot 10^{-18}$ J**.