Answer on Question # 44187, Physics, Nuclear Physics

Task:

a) Calculate the radius of the third orbit of Li2+ ion. Also calculate the energy of the electron in the second orbit of Li2+ ion.

Solution:

the radius of the third orbit of Li2+ ion:

$$r_n = \frac{n^2\hbar^2}{m_e Z e^2} \Rightarrow r_3 = \frac{3^2(1.054\cdot10^{-34})^2}{9.1\cdot10^{-21}\cdot3(1.6\cdot10^{-19})^2} = 0.143\cdot10^{-9} = 1.43\cdot10^{-10}m$$

$$E = \frac{m_e Z^2 e^4}{2n^2\hbar^2} = \frac{9.1\cdot10^{-21}\cdot3^2(1.6\cdot10^{-19})^4}{2\cdot2^2(1.054\cdot10^{-34})^2} = 60.39\cdot10^{-29}J$$

b) Calculate (i) Rydberg constant for Be3+ ion and (ii) fourth ionization energy of beryllium in J atom-1 and kJ mol-1 units.

Solution:

$$R = \frac{2\pi^2 m_e Z^2 e^4}{\hbar^3 c} = \frac{2\cdot3.14\cdot3.14\cdot9.1\cdot10^{-21}\cdot4^2(1.6\cdot10^{-19})^4}{(1.054\cdot10^{-34})^3\cdot3\cdot10^8} = 5.35m^{-1}$$