

Chapter 4 Problem solutions

Problem 9: same as Example 4.5: Cu; $Z=29$
Al; $Z=13$

$$R_{\text{nucleus}} \approx d_{\text{min}} = k \frac{2Ze^2}{K\alpha}$$

Problem 11: Calculate λ for 1st 3 lines of Balmer series

$$\text{Balmer series } n_f = 2 \begin{cases} n_i = 3 \rightarrow n_f = 2 \\ n_i = 4 \rightarrow n_f = 2 \\ n_i = 5 \rightarrow n_f = 2 \end{cases}$$

$$\text{Calculate } E_\gamma = E_i - E_f \\ = E_{\text{upper}} - E_{\text{lower}}$$

$$\lambda = \frac{c}{f} = \frac{hc}{hf} = \frac{hc}{E_\gamma}$$

Problem 16: Energy levels of $\text{Li}^{++} (Z=3)$

$$E_n = -\frac{13.6 Z^2 \text{ eV}}{n^2} = -\frac{13.6 (3)^2 \text{ eV}}{n^2} = -\frac{122.4 \text{ eV}}{n^2}$$

$$E_{g.s.} = E_1 = -122 \text{ eV}$$

$$E_{1^{\text{st}} \text{ Ex. State}} = E_2 = -\frac{122.4}{2^2} = -30.6 \text{ eV}$$

$$E_{2^{\text{nd}} \text{ Ex. State}} = E_3 = -\frac{122.4}{3^2} = -13.6 \text{ eV}$$

Problem (17)

$$r_n = \frac{a_0 n^2}{Z} = \frac{0.529 \text{ \AA} n^2}{Z}$$

$$(a) \text{ He}^+ (Z=2) : r_1 = \frac{0.529 \text{ \AA}}{2} = 0.265 \text{ \AA}$$

$$(b) \text{ Li}^{++} (Z=3) : r_1 = \frac{0.529 \text{ \AA}}{3} = 0.176 \text{ \AA}$$

$$(c) \text{ Be}^{+++} (Z=4) : r_1 = \frac{0.529 \text{ \AA}}{4} = 0.132 \text{ \AA}$$