

3.091 Fall Term 2004
Homework Quiz #2A
Solution outline

Electrons in a gas discharge tube containing $\text{Li}^{2+}(\text{g})$ are excited from the ground state to $n = 3$.

- (a) For each line in the emission spectrum, identify the transition associated with it, e.g., $n = 3 \rightarrow n = ?$

$$n = 3 \rightarrow n = 1$$

$$n = 3 \rightarrow n = 2$$

$$n = 2 \rightarrow n = 1$$

- (b) Calculate the longest wavelength in the emission spectrum of $\text{Li}^{2+}(\text{g})$.

The longest wavelength is associated with the transition between the most closely spaced energy levels. This would be the transition from $n = 3 \rightarrow n = 2$.

$$\begin{aligned} \frac{hc}{\lambda} &= KZ^2 \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \\ \therefore \lambda &= \frac{hc}{KZ^2 \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)} = \frac{6.6 \times 10^{-34} \times 3.00 \times 10^8}{2.18 \times 10^{-18} \times 3^2 \left(\frac{1}{2^2} - \frac{1}{3^2} \right)} \\ &= 7.27 \times 10^{-8} \text{ m} \end{aligned}$$