1. How many subshells are in the following shells: L, N, and O?

2. What electron configuration would you expect \((n\ell)\) for the first excited state of argon and krypton?

3. Using Table 8.1 and Figure 8.2 write down the electron configuration \((n\ell)\) notation of the following elements: potassium, vanadium, selenium, zirconium, samarium, and uranium.

4. List the quantum numbers \((n, \ell, m, m_s)\) for all the electrons in a nitrogen atom.

5. What are the electronic configurations for the ground states of the elements Pd, Hf, and Sb?

6. If the zirconium atom ground state has \(S = 1\) and \(L = 3\), what are the permissible values of \(J\)? Write the spectroscopic notation for these possible values of \(S, L,\) and \(J\). Which one of these is likely to represent the ground state?

7. What are \(S, L,\) and \(J\) for the following states: \(^1S_0, ^2D_{5/2}, ^5F_{1}, ^3F_{4}\)?

8. The \(4P\) state in potassium is split by its spin-orbit interaction into the \(4P_{3/2}\) (\(\lambda = 766.41\)nm) and \(4P_{1/2}\) (\(\lambda = 769.90\)nm) states (the wavelengths are for the transitions to the ground state). Calculate the spin orbit energy splitting and the internal magnetic field causing the splitting.

9. What is the energy difference between a spin-up state and spin-down state for an electron in an \(s\) state if the magnetic field is \(1.7\) T?
10. The spin-orbit effect splits the $3P \rightarrow 3S$ transition in sodium (which gives rise to the yellow light of sodium-vapor highway lamps) into two lines, 589.0 nm corresponding to $3P_{3/2} \rightarrow 3S_{1/2}$ and 589.6 nm corresponding to $3P_{1/2} \rightarrow 3S_{1/2}$. Use these wavelengths to calculate the effective magnetic field experienced by the outer electron in the sodium atom as a result of its orbital motion.

11. The effective nuclear charge that acts on the outer electron in the sodium atom is 1.84\text{e}. Use this figure to calculate the ionization energy of sodium.