1. Reed, Chapter 8, Problem 8-8

2. (a) Write down the quantum numbers for the states described in spectroscopic notation as $^2S_{3/2}$, $^3D_2$ and $^5P_3$.
   (b) Determine if any of these states are impossible, and if so, explain why. (Please note that these could describe states with more than one electron.)

3. What is the ground state electron configuration of a neutral Sodium atom (Z=11)?

4. A certain atom has two optically active electrons that observe LS coupling. One electron is in the 5p subshell, while the other is in 4f. Determine the total quantum numbers $S'$, $L'$, $J'$ for the state of LOWEST energy in this 5p-4f LS coupling configuration. To make sure you have understood: I am referring to only ONE state, namely the state of lowest energy for 5p-4f. Your answer should be a single value of $S'$, a single value of $L'$, and a single value of $J'$. Hint: try using Hund’s rules.

5. Consider the 2p3s configuration of the $^6C$ atom, in which the ordering of the energy levels $S'$, $L'$, $J'$, and the relative strengths of the dependences of the energy on these quantum numbers, are what is normal for LS coupling. Draw a schematic energy-level diagram for this configuration, like we did in class. Use the same (exaggerated) scale for the fine-structure splitting, given by the Landé interval rule, for all the levels within a given multiplet. Don’t forget to label each level with the spectroscopic notation.

6. On the energy-level diagram of the problem above, draw to the same (highly exaggerated) scale the splitting of fine structure energy levels in a weak external magnetic field (Zeeman Effect), given by the Landé g-factor, for each level under the influence of a weak external magnetic field. Hint: Be sure to calculate the g-factor for each level in the previous problem, and then draw how the levels split in a weak external magnetic field. Calculate the spacing in energy between adjacent magnetic substates, in units of $\mu_B B$. 

Homework Assignment #11
Due date: Wednesday, December 4, 2019