1. N identical spin $\frac{1}{2}$ particles are subjected to a one dimensional simple harmonic oscillator potential.

   a) What is the ground state energy (of the whole system)?

   b) Fermi energy is the highest state energy that is occupied in a fermion system. What is it for this system?

   c) What are the ground state and Fermi energies if we ignore the mutual interactions and assume that N is very large.

2. What would happen to the energy levels of a Helium atom if electron were a spinless boson?

3. Suppose electron was a spin $\frac{3}{2}$ particle. Write out the shell configuration of a $Z = 10$ atom made up of such electrons (protons and neutrons stay as usual), i.e. the configuration corresponding to the $(1s)^2(2s)^2(2p)^6$ of a normal atom. Show that the configuration is highly degenerate.

4. Two non-identical spin-1 particles with orbital angular momentum zero (l=0) can form $j = 0, 1, 2$ states. What if the 2 particles were identical? What restrictions will we get?