

CHEM 550 Problem Set #7

Due Mon Dec 1 at 5pm –**PUT IN ANDREAS TILLACKS MAILBOX**

Levine Exercises:

10.18 Spin functions

11.30 Terms, levels, states of carbon

Additional Problems

Spin

- 1) a) Write out *all* of the allowed wave-functions for the first **excited** state of the He atom including electron spin. Which functions correspond to triplet states and which to singlet states.
- b) List 5 particles that are Fermions. List 5 that are Bosons. (Google is fair game if you don't happen to know this many particles off the top of your head!). What do you notice as far as a trend goes for the 'fundamental' particles.

Term symbol practice

- 1) **Derive** (do not just state) the possible term symbols for the $1s^2 2s^2 2p^3$ configuration of a nitrogen atom.

Qualitative Material

- 2) a) Explain why the Hartree-Fock SCF method doesn't obtain the exact ground state energy even though it incorporates an interelectron repulsion term into the Hamiltonian.
- b) Explain why the energy of an orbital depend on l for electrons in atoms other than hydrogen? Annotate your discussion with a *plot* of the radial wave functions for 3s, 3p and 3d.
- c) Rationalize why, all other things being equal, parallel (unpaired) spins *generally* (not always) produce states of lower energy than states with antiparallel (paired) (*Hund's rule*)