5.73

Quiz 31

1. The sp^2 configuration gives rise to ^2D, ^2P, ^4P, and ^2S L–S states. The degeneracy of an L–S state is (2S + 1)(2L + 1). There are six np spin-orbitals and two ns spin-orbitals. The Pauli principle prohibits putting two electrons into the same spin-orbital.

A. What is the total degeneracy of the sp^2 configuration?

B. What is the sum of the degeneracies of the L–S states that arise from sp^2?

C. What is the maximum possible value of M_L among all of the L–S states of sp^2?

D. Write one of the two 3-electron Slater determinant that corresponds to maximum M_L.

E. The maximum M_S value is 3/2. What is the maximum M_L value compatible with $M_S = 3/2$? Write the unique Slater determinant that corresponds to this M_L, M_S pair.

F. $\mathbf{L}^2 = \frac{1}{2}\left(\mathbf{L}_+\mathbf{L}_- + \mathbf{L}_-\mathbf{L}_+\right) + \mathbf{L}_z^2$.

Is $\left\|s0\alpha\ p1\alpha\ p1\beta\right\|$ an eigenstate of $\mathbf{L}^2$? If so, what is its eigenvalue?