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Quiz 31

November 20, 2002

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 the unique 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.
$$\mathbf{L}^2 = \frac{1}{2}(\mathbf{L}_+\mathbf{L}_- + \mathbf{L}_-\mathbf{L}_+) + \mathbf{L}_z^2.$$
 Is $\|s_0\alpha \ p_1\alpha \ p_1\beta\|$ an eigenstate of \mathbf{L}^2 ? If so, what is its eigenvalue?