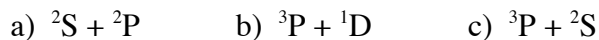


HOMEWORK ASSIGNMENT # 3
DUE: TUESDAY, 10 FEBRUARY 2009

1. Determine the heteronuclear diatomic molecular electronic states arising from the following pairs of atomic states:



2. Use simple MO theory to obtain the ground configuration of the species OH and CO^+ . Order the states arising from these configurations if more than one exists. Then determine whether these states can correlate with ground state atoms. (Note that it is easier to ionize C than O). Relevant bond distances: $CO^+ \approx CO$, $OH < CH$.

3. Use simple MO theory to obtain 1-2 plausible first excited configurations for the following molecules: C_2 , N_2 , O_2 . (The O_2 bond length is intermediate between the other two.) You may assume that the bond distances are not changed much from the respective ground state values. Order the states arising from the configurations. Which of these states have dipole-allowed transitions with the states arising from the ground configuration?

4. Fine structure in a state of $^2\Sigma$ symmetry arises from the "spin rotation" interaction of the rigid body angular momentum \mathbf{N} and the spin angular momentum \mathbf{S} via the interaction $\gamma\mathbf{N}\cdot\mathbf{S}$. Determine the fine structure energies $E(N,J)$ using the fact that the magnitude J of the total angular momentum $\mathbf{J} = \mathbf{N} + \mathbf{S}$ is a good quantum number, as are N and S .

5. Determine the spin-orbit energies in a $^2\Delta$ state.