Name

5.73

Quiz 35

December 2, 2002

1. For p^3 configuration:
The $M_L = 0, M_S = 1/2$ block contains $\|1\alpha 0\alpha - 1\beta\|, \|1\alpha 0\beta - 1\alpha\|,$ $\|1\beta 0\alpha - 1\alpha\|$. For $M_L = 0$, $\mathbf{L}^2$ may be replaced by $\mathbf{L}_+\mathbf{L}_-$.

$$\mathbf{L}^2\|1\alpha 0\alpha - 1\beta\| = \hbar^2\left[2\|1\alpha 0\alpha - 1\beta\| - 2\|1\alpha 0\beta - 1\alpha\|\right]$$
$$\mathbf{L}^2\|1\alpha 0\beta - 1\alpha\| = \hbar^2\left[4\|1\alpha 0\beta - 1\alpha\| - 2\|1\beta 0\alpha - 1\alpha\| - 2\|1\alpha 0\alpha - 1\beta\|\right]$$
$$\mathbf{L}^2\|1\beta 0\alpha - 1\alpha\| = \hbar^2\left[2\|1\beta 0\alpha - 1\alpha\| - 2\|1\alpha 0\beta - 1\alpha\|\right]$$

A. Set up the $\mathbf{L}^2$ matrix for the $M_L = 0$, $M_S = 1/2$ block.

B. Find the eigenvector of $\mathbf{L}^2$ that corresponds to $\left|{}^2\mathrm{D}\ \ M_L = 0,\ M_S = 1/2\right\rangle$

$$(\mathbf{L}^2)\begin{pmatrix} a \\ b \\ c \end{pmatrix} = \hbar^2 6\begin{pmatrix} a \\ b \\ c \end{pmatrix} \qquad 1 = |a|^2 + |b|^2 + |c|^2$$