

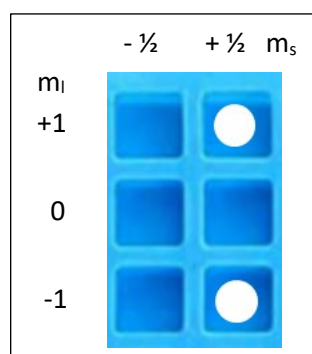
Term symbol In-class activity

Term symbols are the basis for analyzing electronic spectroscopy and determining the number and symmetries of electronic transitions. This activity will allow us to gain a better understanding of the microstates corresponding to a given electronic configuration and how they are grouped into term symbols.

Part I. A p^2 electronic configuration

1. Determine how many microstates are possible for a p^2 electronic configuration. This is simply a probability exercise, in which we have “e” electrons each of which must be placed in one of “n” states. Each state is identified by a m_l number and a m_s number (e.g., $m_l = +1$, $m_s = -1/2$). The total number of microstates is equal to $n!/[(e!)(n-e)!]$.

2. Each of the trays represents one microstate. From question 1, you should know how many trays you need to represent all the microstates for the p^2 configuration. Place two marbles in a tray to portray one microstate. The vertical dimension represents m_l and the horizontal dimension represents m_s . As an example, the diagram at the right represents a microstate with one electron having the quantum numbers $m_l = +1$, $m_s = +1/2$ and the other electron being -1 , $+1/2$. Prepare one tray to represent each of the microstates. Remember that no two microstates should look the same.



3. Determine the first term symbol that you should assign. Remember that term symbol should have the highest possible value of M_L (sum of the m_l values for the individual electrons). If, for that value of M_L , there is more than one possible value of M_S (sum of the m_s values), you should choose the highest value of M_S . Assemble appropriate microstate trays into a group to represent the term symbol.

4. Using the microstate trays that you have left, continue to assemble groups of trays to represent the other term symbols.

5. Assign term symbol names to the groups that you have assembled. Write out the microstates (using the $1^+ 0^-$ notation) that you have included in each term symbol.

6. Take a picture of the assembled term symbol groups.

Part II. A p^3 electronic configuration

Using the microstate trays from part 1, add a third marble to each tray to represent the microstates for the p^3 configuration (you will need some additional trays). Complete the steps from part 1 to assemble the term symbol groups corresponding to p^3 .