Atomic states derived from electronic configuration

There are two ways to set J

1- The first method (LS coupling)

is used when the spin motion does not couple much with the angular momentum of the orbital L of each electron with the rest, resulting in a single resultant symbolized by the quantum letter for that case. Also, the spin momentum of each electron couples with the rest, resulting in a resultant momentum S and L values, S of all the spin motions, which are symbolized by the quantum letter

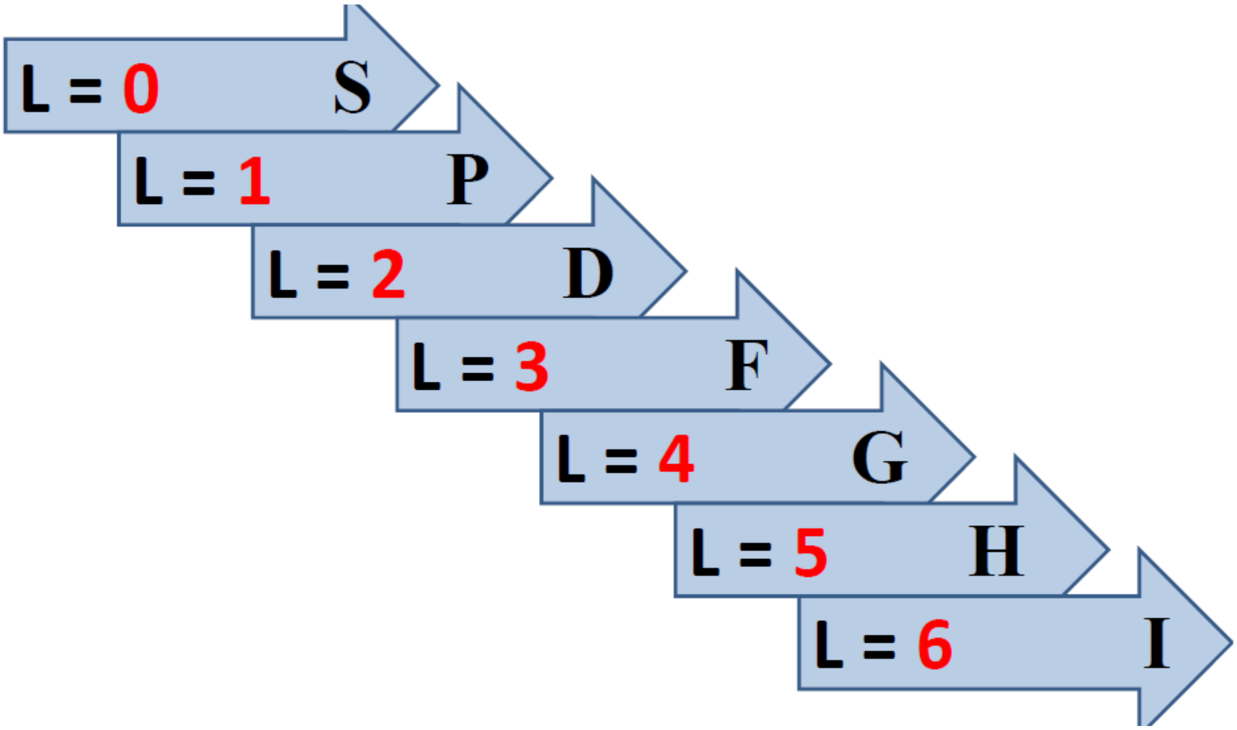
2-The second method (jj coupling)

is used when the spin motion of the electron is coupled with the angular momentum of the orbital to a large degree. This method can be explained by saying that the angular momentum of the spin motion for each electron, then the values of j for the electron are coupled with the momentum of the orbital to give one value J for all electrons to give one value, which is J.

Term symbol ($^{2S+1}L_J$)

1- Electrons are distributed in orbitals of equal energy as much as possible, so that we can calculate the value of (S) to calculate the value of 2S+1, which is called the Bermi multiple.

2- Electrons take the orbitals that have the largest value for the number, then the next one, and so on, so that we get the largest value for the angular orbital momentum, L (ml). Scientists have agreed to give capital letter values according to the following system:



3- If the number of electrons in the secondary orbital is:

J - more than half saturated, then we take the highest value for

J - less than half saturated, then we take the lowest value for

J - saturated or half saturated, then there is only one value for

$$J = /L+S/ \ldots\ldots\ldots\ldots\ldots /L-S/$$

To fined **Term symbol ($^{2S+1}L_J$) calculate:**

1) S

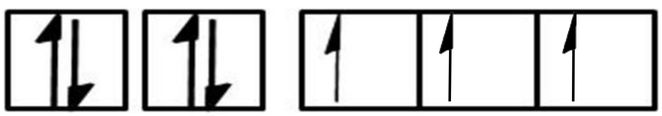
2) 2S+1

3) L

4) J

Example 1/ What is the symbol of the term in the stable state of nitrogen ($_7N$)?

$_7N$:$1S^2\ 2S^2\ 2P^3$



S = (+1/2) + (+1/2)+(+1/2)= 3/2

2S+1 =2× 3/2 + 1= 4

L = (+1) + (0)+(-1)= 0

J = /L+S/ ………/L-S/

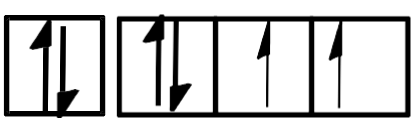
J = /0+3/2/ ………/0-3/2/= 3/2

$$^{2S+1}L_J$$

$$^4S_{3/2}$$

Example 2/ What is the symbol of the term in the steady state of oxygen ($_8O$)?

$_8O$:$1S^2\ 2S^2\ 2P^4$



S = (+1/2)+(+1/2) = 1

2S+1 =2× 1 + 1= 3

L = (+1×2) + (0)+(-1)= 1

J = /L+S/ ………/L-S/

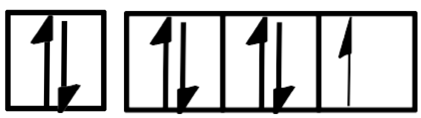
J = /1+1/ ………/1-1/= 2, 1, 0

$$^{2S+1}L_J$$

$$^{3}P_2$$

Example 3/ What is the therm symbol in the stable state of a chlorine atom($_{17}Cl$)?

$_{17}Cl$:$1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^5$



S = +1/2 = 1/2

2S+1 =2× 1/2 + 1= 2

L = (+1 ×2) + (0×2) + (-1×1) = 1

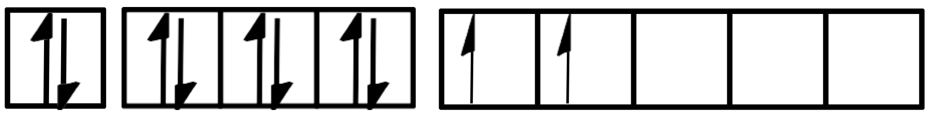
J = /1+1/2/ ………/1-1/2/= 3/2, …,1/2

$$^{2S+1}L_J$$

$$^{2}P_{3/2}$$

Example 4/ What is the thermionic symbol in the stable state of the vanadium ion in the compound VF_3?

$_{23}V^{+3}$: $1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6\ 4S^0\ 3d^2$



S = +1/2 +1/2 = 1

2S+1 =2× 1 + 1= 3

L = (+2× 1) + (+1 × 1) = 3

J = /L+S/ ………/L-S/

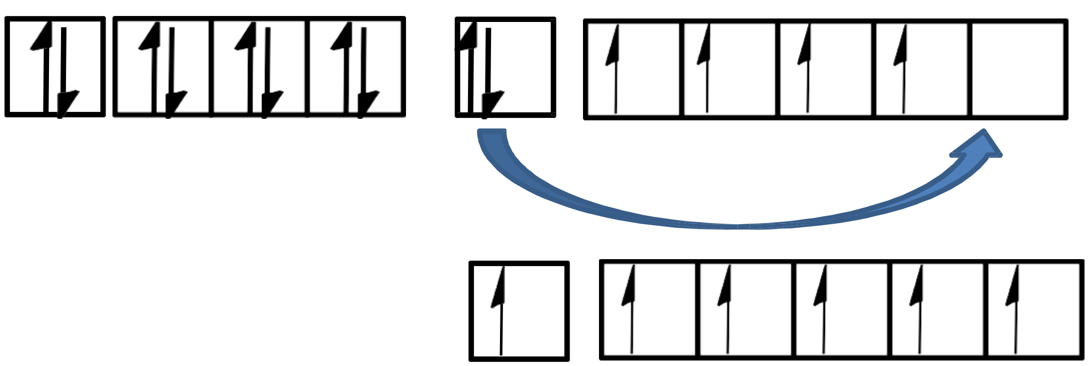
J = /3+1/ ………/3-1/= 4, 3, 2

$$^{2S+1}L_J$$

$$^{3}F_2$$

Example 5/ What is the therm symbol in the stable state of the chromium atom($_{24}Cr$) ?

$_{24}Cr$:$1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6$ $4S^2\ 3d^4$



S = +1/2 +1/2 +1/2 +1/2 +1/2 +1/2 = 3

2S+1 =2× 3 + 1= 7