

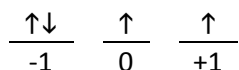
Pre-AP Chemistry
Unit #4—Periodicity

Quantum Numbers

Principal Quantum Number (n) 1, 2, 3, 4, etc...	Determines the total energy of the electron. Describes the energy level of the electron and refers to the average distance of the electron from the nucleus. $2n^2$ electrons may be assigned to an energy level. For $n = 1$, 2 electrons. For $n = 2$, 8 electrons and so on.
Angular Momentum (l) 0, 1, 2, 3, etc...	Refers to the sublevels that occur within each principal energy level and determines the shape of the orbital. It corresponds to the s, p, d, and f orbitals that are in increasing energy. Each l is a different orbital shape or orbital type. This quantum number has integral values from 0 up to $n - 1$.
Magnetic Quantum Number (m_l) ... -2, -1, 0, +1, +2 ...	Specifies which orbital within a sublevel you are likely to find the electron. It determines the orientation of the orbital in space relative to the other orbitals in the atom. This quantum number has values from $-l$ through zero to $+l$.
Spin Quantum Number (m_s) $+\frac{1}{2}$ or $-\frac{1}{2}$	Specifies the value for the spin. Only two possibilities: $+\frac{1}{2}$ and $-\frac{1}{2}$. No more than two electrons can occupy an orbital. In order for two electrons to occupy an orbital, they must have opposite spins.

Determining Quantum Numbers

Now that we know the electron configuration of the valence electron in sulfur is $3p^4$ based on its position in the Periodic Table, and we have a picture of how those p electrons are filling the p sublevel, the set of quantum numbers for this valence electron are extremely easy to obtain. First, $n = 3$ since it is a 3p electron. Next, it is a p electron, and p sublevels have an l value of 1. So far we know 3, 1. To get the magnetic quantum number, m_l , we go back to the orbital notation for the valence electron and focus on the 3p sublevel alone.



Simply, number the blanks with a zero assigned to the center blank and increasing negative numbers to the left and increasing positive numbers to the right of the zero. The last electron was number 16, and it “landed” in the first blank as a down arrow. This picture gives us the last two quantum numbers of $m_l = -1$ and $m_s = +\frac{1}{2}$.

For assigning m_s , the first electron placed in an orbital, the up arrow, gets the $+\frac{1}{2}$, and the second one, the down arrow, gets the $-\frac{1}{2}$.

Quantum numbers are a set of the four numbers that describe an electron’s position within an atom. They are quite easy to determine if you start with the electron configuration. Each electron in the atom has a set of quantum numbers, but you will most often be asked for the set describing the valence electron.