The Spin Quantum Number ($m_s$) describes the angular momentum of an electron. An electron spins around an axis and has both angular momentum and orbital angular momentum. Because angular momentum is a vector, the Spin Quantum Number ($s$) has both a magnitude ($1/2$) and direction (+ or -).

Each orbital can only hold two electrons. One electron will have a +1/2 spin and the other will have a -1/2 spin. Electrons like to fill orbitals before they start to pair up. Therefore the first electron in an orbital will have a spin of +1/2. After all the orbitals are half filled, the electrons start to pair up. This second electron in the orbital will have a spin of -1/2. If there are two electrons in the same orbital, it will spin in opposite directions.

**Combinations of Quantum Numbers**

- The three quantum numbers ($n$, $l$, and $m$) that describe an orbital are integers: 0, 1, 2, 3.
- The principal quantum number ($n$) cannot be zero. The allowed values of $n$ are therefore 1, 2, 3, 4...
- The angular quantum number ($l$) can be any integer between 0 and $n - 1$.
  - If $n = 3$, $l$ can be either 0, 1, or 2.
- The magnetic quantum number ($m$) can be any integer between $-l$ and +$l$.
  - If $l = 2$, $m$ can be -2, -1, 0, +1, or +2.
- Orbitals that have same value of principal quantum number form a Shell($n$).
- Orbitals within the shells are divided into subshell ($l$)
  - $s:l = 0$ $p:l = 1$ $d:l = 2$ $f:l = 3$

**Exercise \(\PageIndex{1}\): Tungsten**

What is the spin quantum number for Tungsten (symbol W)?

**Answer**

Tungsten has 4 electrons in the 5d orbital. Therefore 1 electron will go into each orbital (no pairing). The 4th electron will have a +1/2 spin.

**Exercise \(\PageIndex{2}\): Gold**

What is the spin quantum number for Gold (symbol Au)?

**Answer**

Gold has 9 electrons in the 5d orbital. Therefore the electrons will start to pair up, which means the 9th electron will pair up, giving it a -1/2 spin.

**Exercise \(\PageIndex{3}\): Sulfur**

What is the spin quantum number for Sulfur (symbol S)?

**Answer**

Sulfur has 4 electrons in the 3p orbitals. The 4th electron in this orbital will be the first one to pair up with another electron, therefore giving it a -1/2 spin.