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 \((n, l, \text{ and } m)\) 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.
References
