Electron Configuration

1. What is an electron configuration?

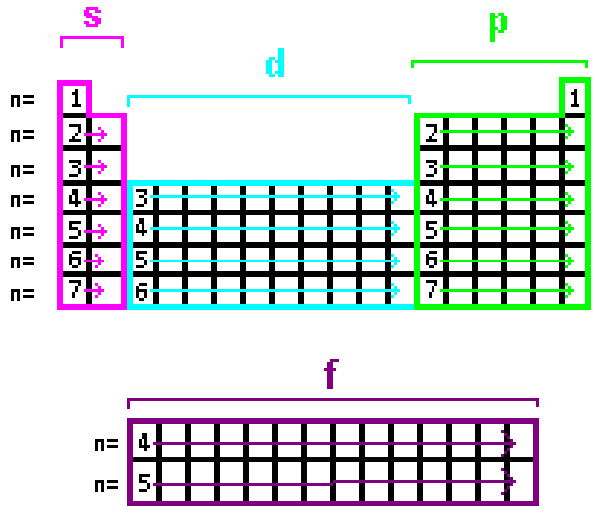
A notation for indicating where all of the electrons in a particular atom/ion. When we write electron configurations, we must fill electrons into orbitals in order of lowest to highest energy. This cannot be determined by comparing values of n.

2. What is the Aufbau Principle?

The "building up" principle. Start at the lowest energy orbital and move up.

3. How can you figure out how to order the orbitals?

You can either memorize the order or use the periodic table.



4. What is Hund's Rule?

This rule basically instructs us to separate electrons out when creating the

configuration. For example in a p orbital electrons should be spread out as:

 NOT

5. What is long hand vs. short hand electron configuration?

Long hand notation is where every single orbital in the electrons configuration is written out.

The long hand notation for Mg is $1s^2 2s^2 2p^6 3s^2$

The short hand notation references the closest noble gas (as it would have the same configuration as that noble gas) plus the additional electrons placement.

The short hand notation of Mg is $[Ne]3s^2$

6. What "families" of elements have an exception to the normal method of writing out electron configurations?

The elements with 4 electrons in the d orbital (including Cr, Mo and W). Normally you would create an electron configuration that looked like:

[noble gas] $ns^2 (n-1)d^4$ instead it is written [noble gas] $ns^1 (n-1)d^5$

The elements with 9 electrons in the d orbital (including Cu, Ag and Au). Normally you would create an electron configuration that looked like:

[noble gas] $ns^2 (n-1)d^9$ instead it is written [noble gas] $ns^1 (n-1)d^{10}$

7. Write the short hand electron configurations for

   a. Fe
   [Ar]$4s^2 3d^6$

   b. Hf
   [Xe]$6s^2 4f^{14} 5d^2$

   c. Cr* an exception
   [Ar]$4s^1 3d^4$

   d. Cu* an exception
   [Ar]$4s^1 3d^{10}$

8. Which configuration indicates an excited state?

9. An excited state is one in which electrons are in higher energy orbitals than they would normally be (i.e. not ground state). The way you can tell if this is the case is to look and see if the electrons fill in the normal pattern (which would indicate ground) or an abnormal pattern (an indication of excitement).

   a. $1s^2 2s^2 3p^1$

      This would be an excited state. The ground state configuration would be $1s^2 2s^2 2p^1$

   b. $1s^2 2s^2 2p^6$

      This follows ground state configuration – this means it is not excited.

   c. $1s^2 2s^2 2p^4 3s^1$

This corresponds to an excited state. The "normal" configuration would be $1s^2 2s^2 2p^5$

d. $[Ar]4s^1 3d^{10}$

This is ground state – remember that this is the ground state configuration of Cu. Usually something like this would indicate an excited state – this is just one of the exceptions.

10. Write the electron configuration for Sc^+.

When creating the electron configuration for an ion – begin by removing the electrons from the highest energy shell (highest n-value) first.

Sc: $[Ar]4s^2 3d^1$ from this we can see that n=4 is the highest energy level. This means that we pull the first electron from the 4s orbital. This gives us:

$$Sc^+ = [Ar]4s^1 3d^1$$