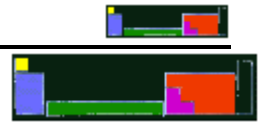
Revised August 2012



HONORS WORKSHEET 7b: Orbital filling rules

The rules that you have been applying in order to determine the electronic configuration of an atom are summarized below.

A. Lowest energy orbitals are filled first. **THE AUFBAU PRINCIPLE**.

B. Orbitals can only contain a maximum of two electrons and when two electrons enter the same orbital they must have opposite spins (+ ½ or – ½) so that each electron has a unique set of quantum numbers. (In the electrons in boxes diagram they must be drawn ↑↓ **NOT** ↑↑ **OR** ↓↓). **THE PAULI EXCLUSION PRINCIPLE**.

C. When orbitals of identical energy (degenerate) are available electrons enter these orbitals singly before any spin pairing takes place. **HUNDS RULE**.

D. There are some notable exceptions. For example Cr and Cu achieve extra stability by forming a half-filled and completely filled d sub-shell respectively by using one of their 4s electrons.

Consider each of the elements listed and the INCORRECT electronic configuration associated with each one. In each case identify which of the above rules or principles (**A**, **B**, **C** or **D**) is violated and insert the correct electronic configuration (in a similar format to that of the incorrect configuration). Then add a possible set of quantum numbers for the outer most electron. An example is completed for you.

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ELEMENT	INCORRECT CONFIGURATION	VIOLATION	CORRECT CONFIGURATION	*POSSIBLE* SET OF QUANTUM NUMBERS FOR OUTERMOST* ELECTRON			
N	**$1s^2\ 2s^2\ 2px^2\ 2py^1$**	**C**	**$1s^2\ 2s^2\ 2px^1\ 2py^1\ 2pz^1$**	**2**	**1**	**-1**	**+½**
Al	$1s^2\ 2s^2\ 2p^6\ 3p^3$						
B	$1s^2\ 2s^3$						
P	$1s^2\ 2s^2\ 2p^6\ 3p^5$						
Cu	[Ar] $4s^2\ 3d^9$						
Mg	[Ne] ↑↑						
C	$1s^2\ 2s^1\ 2px^1\ 2py^1\ 2pz^1$						
C	$1s^2\ 2s^2\ 2px^2$						
Ag	[Kr] $5s^2\ 4d^9$						
Mn	[Ar] $4s^1\ 3d^6$						
Ni	[Ar] $4s^2\ 3d_{xy}^2\ 3d_{xz}^2\ 3d_{yz}^2\ 3d_{z2}^2\ 3d_{x2-y2}^0$						
Cl	[Ne] ↓↓ ↑↑ ↓↓ ↑						
Sc	[Ar] $3d^3$						
B	$1s^2\ 2s^1\ 2px^1\ 2py^1$						
Na	$1s^1\ 2s^2\ 2p^6\ 3s^2$						
S	[Ne] $3s^2\ 3px^2\ 3py^2$						
V	[Ar] $3d^5$						
P	[Ne] $3s^2\ 3px^2\ 3py^1$						
Kr	[Ar] $4s^2\ 3d^{16}$						
Cr	[Ar] $4s^2\ 3d^4$						

***In d block elements, assume that the outermost electron is in the outer s orbital rather than the outer d orbital.**