



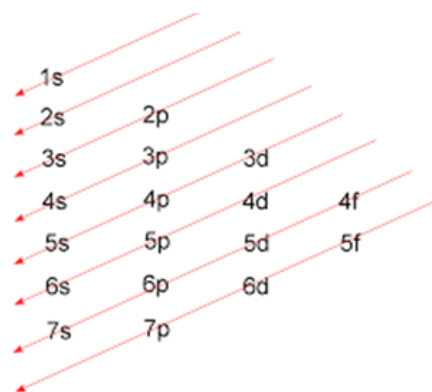
CHE 1020: Electron configuration lab WS

Many of the concepts introduced in module 3 are abstract and difficult to wrap your mind around while listening to lectures or reading words on a page. This worksheet asks you to apply the rules of electron configuration (Aufbau) to increase your understanding of the quantum mechanical model of the atom. If you go on to organic chemistry, this skill is foundational!

Remember:

- Subshells with multiple orbitals at the same level (p, d, and f) add one electron to each of the multiple orbitals that share a common energy level before a second electron is added to any of them (Hund's rule).
- When two electrons occupy the same orbital those two electrons have opposite spin. (Pauli)
- Metals lose electrons to become cations and empty their valence shell.
- Non-metals gain electrons to become anions and fill their valence shell.
- For transition metals:
- Higher s orbitals fill before the lower d orbital.
- When transition metals lose electrons their higher s orbitals lose electrons before the lower d orbitals.

To 'write' an atom's ground state electron configuration, fill orbitals in the order (Aufbau) indicated by the red arrows in the 'Christmas tree diagram' shown here. Being able to create the Christmas tree diagram on a blank sheet of paper is a skill worth having!



Element	Total Electrons	Orbital Diagram				Electron Configuration
		1s	2s	2p	3s	
Li	3	$\uparrow\downarrow$	\uparrow	\square \square \square	\square	$1s^2 2s^1$
Be	4	$\uparrow\downarrow$	$\uparrow\downarrow$	\square \square \square	\square	$1s^2 2s^2$
B	5	$\uparrow\downarrow$	$\uparrow\downarrow$	\uparrow \square \square	\square	$1s^2 2s^2 2p^1$
C	6	$\uparrow\downarrow$	$\uparrow\downarrow$	\uparrow \uparrow \square	\square	$1s^2 2s^2 2p^2$
N	7	$\uparrow\downarrow$	$\uparrow\downarrow$	\uparrow \uparrow \uparrow	\square	$1s^2 2s^2 2p^3$
Ne	10	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$	\square	$1s^2 2s^2 2p^6$
Na	11	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$	\uparrow	$1s^2 2s^2 2p^6 3s^1$



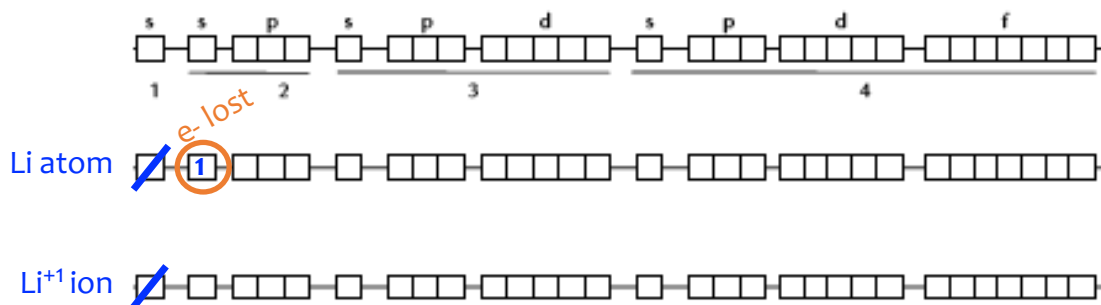
Instructions:

For each element shown in the table on page 3:

- (1) Complete the table by filling in the missing information; and
- (2) use the orbital box diagrams on pages 4 – 6 to write out the electron configuration of each element and its ion.
 - To save time you may use a slash through boxes (orbitals) that hold two electrons but use a single up arrow to represent a single electron.
 - Note that the box diagrams **don't follow the aufbau order!** You have remember to check that.
 - Watch out for transition metals!
 - Think about how electron configuration would change if and when the element becomes an ion. (And remember that not all elements form ions!)
 - You can show the difference between atoms and ions by altering the electron configuration of the atom with another color pen or pencil to indicate how many electrons have been lost or gained and in which orbitals.
 - Can you see patterns when atoms are found in the same row or column of the periodic table? If so, what types of patterns?

Example:

Element	Column	Row	Atomic number	Ionic charge?
Li	1	2	3	+1



You can either show where electrons are lost or gained from the atom or create a new electron configuration for the ion.



Table of elements to Aufbau

- Fill in the missing information.
- For transition metals, use a charge of +2.

Element	Column	Row	Atomic number	Ionic charge?
Na				
Mg				
Al				
Si				
P				
S				
Cl				
Ar				
K				
Ca				
Fe				
Co				
Ni				
Cu				
Zn				
Br				
Kr				

