Model: Drawing Lewis Dot Structures for Atoms and Ions

Lewis Dot structures are valuable tools for diagraming how atoms bond with one another to form compounds. They identify how many ***valence electrons*** (electrons in the outer-most shell or energy level) are found around an atom and provide a visual confirmation of how the atom can most easily achieve the ***stable noble gas configuration*** (stable octet).

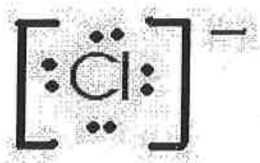
A Lewis Dot structure is written by including the ***elemental symbol*** for the atom you are diagraming, surrounded by the appropriate number of ***valence electrons.***

A) Lewis dot structure for an atom of *chlorine* is

The number of valence electrons for an atom is the number of electrons in the outer-most energy level (shell) of the atom. Since chlorine's electron configuration is $1s^2 2s^2 2p^6 3s^2 3p^5$, we add up the number of electrons in the highest energy level (3^{rd} energy level) to determine the number of valence electrons.

$3s^2 3p^5$ means there are 2 + 5 = 7 valence electrons

B) Lewis Dot structure of a *chlorine ion* is



To fill its outer shell, chlorine may either lose its 7 valence electrons or gain 1 valence electron. As we've seen, metals tend to give electrons to form cations and non-metals tend to gain electrons to form anions. Chlorine, a non-metal, needs an additional electron to attain the stable noble gas configuration of 8 valence electrons.

When chlorine becomes an ion, we add one more dot to the Lewis Dot diagram to show the gain of an electron and put the resulting charge of -1 around the diagram in brackets.

C) Now try drawing the Lewis Dot structure for sodium. Include the electron configuration!

Sodium has an electron configuration of $1s^2 2s^2 2p^6 3s^1$, therefore it has one valence electron in the ***3rd energy level*** and need only one dot in the diagram.

D) Now draw the Lewis Dot structure for a sodium ion. Include the electron configuration!

Since sodium is a metal of a fixed charge, it forms a +1 cation by ***giving*** its single valence electron to achieve the stable noble gas configuration of 8 valence electrons in the ***2nd energy level***. You should have taken away 1 dot from the neutral sodium Lewis Dot diagram and put the resulting +1 charge in brackets around the diagram.

E) Using Lewis Dot diagrams to predict compound formulas.

We have seen that we can predict the proper chemical formulas for compounds by balancing the charges the ions/polyatomic ions like to take-on. Now, we also know why the elements tend to take-on these specific charges – they are trying to achieve the ***more stable noble gas*** confirmation. Using this knowledge, we can show how elements achieve a nobel gas confirmation through bonding.

Draw the Lewis Dot diagrams of neutral sodium and chlorine atoms and show how each achieves a noble gas confirmation by bonding to each other.

Na Cl

[Na] [Cl]

Now draw the Lewis Dot diagrams of neutral magnesium and bromine atoms and show how each achieves a noble gas confirmation by bonding to each other.

Mg Br

Notice how, since magnesium wants to ***give away 2*** valence electrons and bromine only wants to ***accept 1*** electron, 2 bromine atoms must bond with 1 magnesium atom to achieve the stable noble gas configuration for all atoms.