Ions:

* An ion is an atom that has *different numbers of PROTONS and ELECTRONS.*
* In other words: An ion is an atom that has *a NET ELECTRIC CHARGE.*

As we already know protons carry a charge of **+1** while electrons carry a charge of **-1**. Most atoms, and therefore most objects are *neutral* because they have an exact balance of protons and electrons.

However, an atom can gain or lose electrons as it randomly zips about, and when it does it ends up with an imbalance between electrons and protons. When this happens the atom will have a *NET or OVERALL CHARGE.*

* **IF AN ATOM HAS MORE PROTONS THAN ELECTRONS (IT HAS LOST ELECTRONS) IT WILL HAVE A NET \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CHARGE AND WILL BE CALLED A \_\_\_\_\_\_\_\_\_\_\_\_\_\_ .**
* **IF AN ATOM HAS MORE ELECTRONS THAN PROTONS (IT HAS GAINED ELECTRONS) IT WILL HAVE A NET \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CHARGE AND WILL BE CALLED AN \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .**

As atoms fly around (very quickly! a molecule of O2 in the air at 20oC is moving at 2500km/h) they can lose or gain electrons in all sorts of ways. However *atoms are most stable when then have a FULL VALENCE SHELL*. Atoms can get a full valence by gaining electrons (How many electrons would fluorine need to gain?) or by losing electrons.

EXAMPLES: Draw a BOHR model of OXYGEN:

How many electrons must it LOSE or GAIN to have a full valence shell?

What is its ion charge?

Is this an ANION or CATION?

EXAMPLES: Draw a BOHR model of BERYLIUM:

How many electrons must it LOSE or GAIN to have a full valence shell?

What is its ion charge?

Is this an ANION or CATION?

EXAMPLES: Draw a BOHR model of CHLORINE:

How many electrons must it LOSE or GAIN to have a full valence shell?

What is its ion charge?

Is this an ANION or CATION?

EXAMPLES: Draw a BOHR model of SODIUM:

How many electrons must it LOSE or GAIN to have a full valence shell?

What is its ion charge?

Is this an ANION or CATION?

Science 10: Ionic Compounds

Compounds are formed when two or more elements combine. This can happen in two main ways.

1. **Ionic Compounds** are formed when a metal donates electrons to a non-metal. In the process the metal becomes a **cation** (+ charge) and the non-metal becomes an **anion** (- charge). The two (or more) ions then become stuck together (positives and negatives are attracted!) to form an ionic compound.

* Ionic bonds are always between a METAL and a NON-METAL

2. **Covalent Compounds** are formed when two (or more) non-metals share electrons. This type of bond is generally weaker than an ionic bond. The result is still that each atom ends up with full valence shell.

* Covalent bonds are always between NON-METALS

**Ionic Compounds:**

Example: Sodium + Chlorine

Extra electron

BOHR

Sodium Chlorine

Empty Spot

LEWIS DOT

* Sodium has one extra electron, Chlorine has one too few; It’s a match made in heaven!
* So sodium can donate one electron to chlorine and both will end up with a full valence shell.
* To do this the atoms must move close together.
* When sodium gives up one electron it becomes an ion with a charge of 1+. When chlorine accepts an extra electron it becomes an ion with a charge of 1- (**A chloride ion**).
* These two ions then ‘stick’ with a force of *electrostatic attraction* together forming a NaCl molecule. The **net charge** of the molecule will be 0.

LEWIS DOT BOHR

Na Cl

The positive sodium ion and the negative

chloride ion are now electrically attracted.

Na+ Cl-

+ - The two become ‘stuck’ together with an *electrostatic force*. This is a new molecule!

NaCl

The last diagram(s) show a single molecule of NaCl, Sodium Chloride. Notice that the net charge of the MOLECULE is ZERO.

**Rule for Naming Ionic Compounds:**

Ex 2: Magnesium and Fluorine.

Florine Magnesium

* This is a little different. Magnesium has two extra electrons, fluorine only need one.
* In order for the compound to form **all atoms must end up with full valence shells**.
* This means we will need two fluorine atoms.
* Magnesium can donate both electrons, each fluorine can accept one.
* The atoms must move close together.
* Mg becomes Mg2+. Each F becomes F- (fluoride).
* The ions then ‘stick’ together with a force of *electrostatic attraction* forming a MgF2 molecule. The **net charge** of the molecule will be 0.

LEWIS BOHR

When the electrons leave the outer (3rd)

shell of Mg, that shell is empty, and so it

is NOT A SHELL AT ALL!

F Mg F

Notice that the atoms all *look* the same.

What makes them different?

F- Mg2+ F-

- 2+ -

Now each atom has a FULL VALENCE

SHELL.

MgF2

The last diagram shows a single molecule of Magnesium Fluoride.

**Your turn:**

1. Beryllium + oxygen. For this example draw all three steps showing, with arrows how the electrons move. At the last step name the compound.

2. Sodium + Oxygen. For this example draw all three steps showing, with arrows how the electrons move. At the last step name the compound.

3. Lithium + Nitrogen. For this example see if you can skip right to the final molecule. Name the compound.