**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_**

**Ionic Bonding Puzzle Activity**

**Introduction**

When metals and non-metals react with each other, the atoms form **ions** or charged atoms. Ions form because **electrons** are either gained or lost. Metals form **cations** or positive ions, because they **give up electrons** Non-metals will form **anions** or negative ions, because they **accept electrons**.

|  |  |  |  |
| --- | --- | --- | --- |
| compound  attracted  nonmetal  ratio | cations  charges  positive  neutral | subscripts  gain  opposite  lose | metal  negative  anions |

Use the word bank above to fill in the blanks in the **Introduction to Ionic Bonding** below.

**Introduction to Ionic Bonding**

Here are some examples of ***ionic compounds***:

NaCl Al2O3 Li2SMgCl2 Ag3P CuBr2 FeO

Metals \_\_\_\_\_\_\_\_\_\_\_\_\_ electrons and become positive ions or \_\_\_\_\_\_\_\_\_\_\_\_\_\_, and nonmetals \_\_\_\_\_\_\_\_\_\_ electrons and become negative ions or \_\_\_\_\_\_\_\_\_\_\_\_\_. The cations and anions are

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to each other because of their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charges. Al2O3

In a chemical formula, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ show the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of each atom in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. For an ionic compound, the sum of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charges, and the sum of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charges must be equal to zero to make the compound \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When writing the formula for a compound the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is always written first and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ comes second.

The ratio of a +1 cation to a -1 anion is 1:1 so that the charges are balanced.

K1+ + Cl1- KCl

The ratio of a +2 cation to a -1 anion is 1:2 so that the charges are once again balanced. A (+2) ion is balanced by 2 (-1) ions.

Ca2+ + 2 I1- CaI2

**Activity**

In this activity you will create models of ionic compounds and observe patterns in the chemical formula of the compounds you have created. Each compound should be constructed with the correct number of cations and anions so that all the tabs and slots are connected and the charges in the compound are balanced. Record your results in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Combination:** | **Cation symbol with charge** | **Anion symbol with charge** | **Compound Formula** | **Sum of (+) Charge** | **Sum of (-) Charge** |
| Titanium (IV) and oxide |  |  |  |  |  |
| Bromide and Yttrium (III) |  |  |  |  |  |
| Calcium and Phosphide |  |  |  |  |  |
| Lithium and Oxide |  |  |  |  |  |
| Iron (III) and Oxide |  |  |  |  |  |
| Sodium and Iodide |  |  |  |  |  |
| Iron (II) and Chloride |  |  |  |  |  |
| Sulfide and Silver |  |  |  |  |  |
| Magnesium and Iodide |  |  |  |  |  |
| Copper (II) and Oxide |  |  |  |  |  |
| Potassium and Sulfide |  |  |  |  |  |
| Iron (III) and Bromide |  |  |  |  |  |
| Oxide and Magnesium |  |  |  |  |  |
| Potassium and Phosphide |  |  |  |  |  |

Discussion Questions:

1. Describe any patterns you see regarding the family or group number and the charge and number of tabs or slots.
2. What do you notice about the sum of the positive charges and the sum of the negative charges in each of the compounds you formed? If the positive charges and added to the negative charges, what is the result? Explain why this occurs.
3. Describe a relationship you observe between the (+) charge and the (-) charge on the ions and the subscripts in the formula.
4. Complete the table below to write formulas for compounds formed from the metals and nonmetals given.

|  |  |  |  |
| --- | --- | --- | --- |
| Metal and nonmetal | Cation | Anion | Compound Formula |
| Barium and fluorine |  |  |  |
| Sodium and oxygen |  |  |  |
| Aluminum and sulfur |  |  |  |
| Magnesium and phosphorus |  |  |  |