Binary Compounds of Metals with Fixed Charges

Given Name, Write the Formula

A binary compound is one made of two different elements. There can be one of each element such as in sodium bromide or potassium iodide. There can also be several of each element such as lithium oxide or aluminum bromide.

Please remember that all elements involved in this lesson have **ONLY ONE** charge. That includes **BOTH** the metal **AND** the nonmetal involved in the formula.

Points to remember about writing the formula from the name

1. The order in a formula is first the cation, then the anion.
2. You must know the charges associated with each cation and anion.
3. The sum of the positive charge and the sum of the negative charges MUST add up to zero.
4. You **MAY NOT** adjust the charges of the cations or anions to get a total charge of zero.
5. You **MAY** adjust the subscripts to get a total charge of zero.

Example 1: Write the formula from the following name: **sodium bromide**

Step #1 - Write down the symbol and charge of the first word. Result = Na^{+}

Step #2 - Write down the symbol and charge of the second word. Result = Br^{-}

Step #3 - Use the minimum number of cations and anions needed to make the sum of all charges in the formula equal zero. In this case, only one Na^{+} and one Br^{-} are required.

The resulting formula is NaBr.

Example 2: Write the formula from the following name: **potassium chloride**

Step #1 - Write down the symbol and charge of the first word. Result = K^{+}

Step #2 - Write down the symbol and charge of the second word. Result = Cl^{-}

Step #3 - Use the minimum number of cations and anions needed to make the sum of all charges in the formula equal zero. In this case, only one K^{+} and one Cl^{-} are required.

The resulting formula is KCl.

Example 3: Write the formula from the following name: **barium iodide**

Step #1 - Write down the symbol and charge of the first word. Result = Ba^{2+}

Step #2 - Write down the symbol and charge of the second word. Result = I^{-}

Step #3 - Use the minimum number of cations and anions needed to make the sum of all charges in the formula equal zero. In this case, only one Ba^{2+} is required, but two I^{-} are required.

Why? Answer - Two negative one charges are required because there is one postive two charge. Only in this way can the total charge of the formula be zero.

The resulting formula is BaI_2.

Example 4: Write the formula from the following name: **aluminum chloride**

Step #1 - Write down the symbol and charge of the first word. Result = Al^{3+}

Step #2 - Write down the symbol and charge of the second word. Result = Cl^{-}

Step #3 - Use the minimum number of cations and anions needed to make the sum of all charges in the formula equal zero. In this case, only one Al^{3+} is required, but three Cl^{-} are required.

Why? Answer - Three negative one charges are required because there is one postive three charge. Only in this way can the total charge of the formula be zero.

The resulting formula is $AlCl_3$.

Example 5: Write the name of the following formula: **magnesium oxide**

Step #1 - Write down the symbol and charge of the first word. Result = Mg^{2+}

Step #2 - Write down the symbol and charge of the second word. Result = O^{2-}

Step #3 - Use the minimum number of cations and anions needed to make the sum of all charges in the formula equal zero. In this case, one Mg^{2+} is required, as well as one O^{2-}.

Why? Answer - One positive two charge is counterbalanced by one negative two charge. This gives a zero total charge for the formula.

The resulting formula is MgO.

Example 6: Write the name of the following formula: **aluminum oxide**

Step #1 - Write down the symbol and charge of the first word. Result = Al^{3+}

Step #2 - Write down the symbol and charge of the second word. Result = O^{2-}

Step #3 - Use the minimum number of cations and anions needed to make the sum of all charges in the formula equal zero. In this case, two Al^{3+} are required and three O^{2-}.

Why? Answer - This is the only possible way to get the positive and negative charges equal and keep the numbers to a minimum. Note that the positive charge is a +6 and the negative charge is a -6.

Also, keep in mind that you cannot change the charges to make a formula correct.

The resulting formula is Al_2O_3.

Warning: beware of the temptation to write the above formula as Al_3O_2.

Practice Problems

Write the correct formula for:

1) magnesium oxide

2) lithium bromide

3) calcium nitride

4) aluminum sulfide

5) potassium iodide

6) strontium chloride

7) sodium sulfide

8) radium bromide

9) magnesium sulfide

10) aluminum nitride

Write the correct formula for:

11) cesium sulfide

12) potassium chloride

13) strontium phosphide

14) barium iodide

15) sodium fluoride

16) calcium bromide

17) beryllium oxide

18) strontium sulfide

19) boron fluoride

20) aluminum phosphide

Write the correct formula for:

21) rubidium oxide

22) calcium iodide

23) cesium oxide

24) magnesium iodide

25) lithium chloride

26) beryllium bromide

27) sodium oxide

28) calcium fluoride

29) boron phosphide

30) aluminum oxide