Chemical Formulas (Polyatomic Ions)

Some ions you find in a table of common ions contain more than one element. Groups of atoms of more than one element that carry a charge are called **polyatomic ions. (**poly means many or more than one) Some chemists call them **radicals.**

The atoms that make up a polyatomic ion are bound to each other very tightly. They do not ordinarily break apart during chemical reactions, but rather function as a unit. Thus, these groups of atoms behave as though they were single atoms. The rules for writing formulas can be used to write the formulas containing polyatomic ions if a fourth rule is added.

Rule 4

When using subscripts with polyatomic ions, the symbol (formula of the ion) is placed in parentheses, and the subscript is placed outside the parentheses. **[You can still use the crisscross method]**

EXAMPLE 1

Write the formula for calcium hydroxide.

SOLUTION

This compound is made of Ca^{+2} ions and hydroxide ions which are OH^{-1}. In order to get the charges to balance out and make a neutral compound we will need one Ca and two OH groups. We could write $CaOH_2$; but this would be wrong. This formula doesn't give us two OH groups it only gives us two H's. To get two entire OH groups we need to use parentheses to enclose the entire OH unit. The correct formula then becomes...

$$Ca(OH)_2$$

EXAMPLE 2

Write the formula for ammonium phosphate.

SOLUTION

Ammonium is NH_4^{+1} and phosphate is PO_4^{-3}. In order to get the charges to balance by crisscrossing the numbers we need three ammonium groups for each one phosphate group. We will need to use parentheses around any group we use more than one time... in this case the ammonium group.

The formula then is

$$(NH4)_3P\,O_4$$

TEACHER ASSISTED PRACTICE

Write the formulas for each of the following compounds that contain polyatomic ions (radicals): (Use your common ion tables)

1. Aluminum Sulfate

2. Magnesium Nitrate

3. Calcium Phosphate

4. Ammonium Sulfate

5. Sodium Phosphate

6. Barium Carbonate

7. Calcium Acetate

8. Ammonium Sulfide

9. Magnesium Phosphate

10. Silver Peroxide

STUDENT PRACTICE PROBLEMS

1. Calcium Nitrate

2. Mercury II Cyanide

3. Aluminum Dichromate

4. Zinc Hydroxide

5. Ammonium Nitrite

6. Barium Nitrate

8. Sodium Peroxide

9. Calcium Hydrogen Sulfate

10. Calcium Chlorate

11. Copper I Cyanide

12. Chromium III Tartrate

13. Zinc Phosphate

14. Iron II Sulfate

15. Copper II Chlorite