

## Notes – Counting Atoms in a Formula

In writing out a chemical equation for a reaction, the number of each kind of atom on both the reactant (left) and product (right) side of the equation must be counted, to make sure they are equal.

There are four rules that must be followed in counting atoms:

1. The subscript number to the right of the element symbol indicates the number of atoms of that element. If no subscript number is shown to the right of a symbol, then there is only one atom of that element. For example, in NaCl, there is one atom of sodium (Na) and one atom of Cl (chlorine). In CaCO<sub>3</sub>, there is one atom of calcium (Ca), one atom of carbon (C) and three atoms of oxygen (O).
2. If a group of atoms and subscript numbers are enclosed in a set of parentheses with a subscript number outside and to the right of the parentheses, you must multiply the outside subscript with each separate number of atoms inside the parentheses. For example, in magnesium hydroxide, Mg(OH)<sub>2</sub>, there is one atom of magnesium (Mg) because it has no subscript and is outside the parentheses, but there are two atoms of oxygen (O) and two atoms of hydrogen (H) because the subscript 2 outside the parentheses is multiplied by the one oxygen and one hydrogen inside the parentheses.
3. When a full size number appears before the chemical formula for a molecule, it indicates the number of complete molecules. Thus, you multiply that “coefficient” number by the number of atoms in one molecule. For example, in 2H<sub>2</sub>O, there are four hydrogen (2 x 2) and two oxygen (2 x 1) atoms, twice the number in one water molecule.
4. When the symbol for an element appears more than once in the chemical formula, you must add together the total number of atoms found in all locations. For example, in the cellulose molecule, C<sub>5</sub>H<sub>7</sub>O<sub>2</sub>(OH)<sub>3</sub>, there are a total of ten hydrogen and five oxygen atoms.