

When hydrogen chloride and red oxide of mercury are brought together under proper conditions, in quantities such that the hydrogen of the acid and the oxygen of the oxide are present in the proportions in which they unite to form water, a reaction takes place, the oxide and acid disappear, while water and corrosive sublimate are formed *and nothing else*.

From the composition of three of these substances, therefore, that of the fourth can be calculated. For example —100 grammes of the red oxide contain 92.59 g of mercury and 7.41 g of oxygen, which latter needs 0.933 g of hydrogen to form water. This weight of hydrogen is combined with 32.82 g chlorine in 33.75 g of hydrogen chloride. As *nothing but water and corrosive sublimate* are formed by the reaction, 125.41 g of the latter substance must be produced, containing 92.59 g of mercury, and 32.82 g of chlorine.

The occurrence of reactions of the type known as "double decomposition" or "metathesis" thus establishes the existence of relationships between the compositions of the chemical compounds, which have been made use of since 1791 to supplement the ordinary methods of analysis. Richter, who was the first to call attention to this matter, spoke of it as the "touchstone of analysis."

The fact that the weights of oxygen and chlorine which unite with a certain given weight of mercury will also unite with another fixed weight of hydrogen, may be familiarized by the use of cards, on which names and numbers are written as follows :—

mercury 92.59	oxygen 7.41	hydrogen 0.933	chlorine 32.82
------------------	----------------	-------------------	-------------------

Four cards are sufficient, by interchanging them the symbols of the products of the reaction can be formed from those of the original substances.

### 3. Law of combination in multiple proportions.

If two bodies, A and B, form several chemical compounds with each other, the different weights of B which combine with a fixed weight of A bear a simple ratio to each other. . . . . Dalton, 1803.

It has already been pointed out that two substances may unite in more than one proportion to form several chemical compounds. Oxygen and mercury, for instance, form a black oxide containing 96.15 percent of mercury as well as the red one containing 92.59 percent.

Expressed in this manner, no simple relation between the compositions of these two substances is apparent; if however quantities