The Law of Constant Composition, discovered by Joseph Proust, is also known as the Law of Definite Proportions. It is different from the Law of Multiple Proportions although both stem from Lavoisier's Law of Conservation of Mass. The French chemist Joseph Proust stated this law the following way: "A chemical compound always contains the same elements combined together in the same proportion by mass."

Joseph Proust

Joseph Proust was a French Chemist best known for his analytical abilities. He was once recommended for a job as a chemistry professor at Segovia's Royal Artillery School by none other than Antoine Lavoisier! His experiments with inorganic binary compounds - mostly sulfates, sulfides, and metallic oxides - led him to formulate the Law of Constant Composition. The law was first published in a paper on iron oxides in 1794.

Proust's law was attacked by the respected French chemist Claude-Louis Berthollet who disagreed that chemical combination was restricted to definite saturation proportions. The confusion was caused by the definition of chemical combination; Berthollet classified solutions as chemical combinations while Proust was careful to distinguish between these and true binary compounds. The conflict lasted until John Dalton, an English chemist, came out with an Atomic Theory that favored Proust's law. Swedish chemist Jons Jacob Berzelius established the relationship between Proust's law and Dalton's theory in 1811.

For example, pure water obtained from different sources such as a river, a well, a spring, the sea, etc., always contains hydrogen and oxygen together in the ratio of 1:8 by mass. Similarly, carbon dioxide ($CO_2$) can be obtained by different methods such as,

- Burning of carbon
- Heating of lime stone
- Applying dilute HCl to marble pieces

Each sample of CO$_2$ contains carbon and oxygen in a 3:8 ratio.

Example: Reduction of Cupric Oxide
When 1.375 g of cupric oxide is reduced on heating in a current of hydrogen, the weight of copper remaining 1.098 g. In another experiment, 1.179 g of copper is dissolved in nitric acid and resulting copper nitrate converted into cupric oxide by ignition. The weight of cupric oxide formed is 1.476 g. Show that these results illustrate the law of constant proportion.

**SOLUTION**

**First experiment**

- Copper oxide = 1.375 g
- Copper left = 1.098 g
- Oxygen present = 1.375 - 1.098 = 0.277 g

\[
\text{Percentage of oxygen in CuO} = \frac{(0.277)(100\%)}{1.375} = 20.15\%
\]

**Second Experiment**

- Copper taken = 1.179 g
- Copper oxide formed = 1.476 g
- Oxygen present = 1.476 - 1.179 = 0.297 g

\[
\text{Percentage of oxygen in CuO} = \frac{(0.297)(100\%)}{1.476} = 20.12\%
\]

Percentage of oxygen is approximately (within significant figures limits) the same in both the above cases. So the law of constant composition is illustrated.

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