Conservation of Mass Encyclopedia Article

Conservation of Mass

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Although Flemish chemist Jan van Helmont (1579-1644) and British chemist **Robert Boyle** stated versions of a law of indestructibility of **matter**, it is French chemist Antoine Lavoisier (1743-1794) who is usually given the credit for first clearly expressing and proving the law of conservation of **mass**. He performed a series of careful experiments and quantitative measurements that showed clearly that there is no change in total mass in a **chemical reaction**. English chemist **John Dalton** (1766-1844) explained this observation by proposing (in 1803) that chemical compounds are made up of combinations of elements and that these elements consist of indivisible, indestructible atoms. In a chemical reaction, atoms are not destroyed nor are they changed into atoms of other elements. Atoms are simply rearranged in the product compounds. Since the products contain the same atoms as the reactants, mass is neither destroyed nor created in a chemical process.

With the discovery of the **electron** by J. J. Thomson in 1897 and of the **nucleus** by **Ernest Rutherford** in 1911, it became evident that atoms are, in fact, not indivisible. Atoms are made up of smaller particles: electrons, protons, and neutrons. In 1905 **Albert Einstein** (1879-1955) proposed that in very high-energy processes the mass of these **subatomic particles** may be converted into **energy**. Subsequent experimental evidence proved his proposal to be correct. In these processes, the law of conservation of mass is not obeyed. Since, however, these high-energy transformations do not occur in ordinary chemical reactions, chemists may assume that the law of conservation of mass is followed in the processes with which they are normally involved.