

## MASS AND WEIGHT

The experiments described in the preceding paragraphs shew that the weight of the products of a reaction is the same as that of the original substances; and as in any given place the weight of a body is proportional to its mass, the mass of the products of a reaction must be equal to the mass of the original substances.

A discussion of the relations between weight and mass belongs properly to the subject of mechanics; it is sufficient for the present purpose to say that while the weight of a body is proportional to the force required to lift it perpendicularly, its mass is proportional to the force required to throw it horizontally at a given rate. The mass of any article is independent of its position, but the weight decreases as the equator is approached, and is less at high levels than at low. A piece of brass for example that weighed 50 grammes at the top of the University tower, would weigh half a milligramme more if suspended from the pan of the balance by a thread 100 feet long; and a consignment of diamonds from South Africa weighs more in London than in Johannesburg—however, as the weights against which the stones are balanced are likewise heavier in London, the Consignee profits nothing.

It is impossible, consequently, to speak of a "law of the conservation of weight," but the chemical experiments just discussed, together with evidence that mass is unaffected by position, establish the law of the conservation of mass.

The expression "conservation of matter" is often used in this connection; but as "matter" is a metaphysical conception, very difficult to define, it is better to stick to a name that has direct reference to the experiments.

## COMPOUNDS

When two or more substances react and form but one product, the latter is called a "compound" and is often said to "contain" the others; 100 g of water and 10 g of salt for instance react to form 110 g of brine, "which contains 100 g of water and 10 g of salt," and one gramme of hydrogen reacts with 8 g of oxygen forming 9 g of steam, each gramme of which "contains"  $\frac{1}{9}$  g of hydrogen and  $\frac{8}{9}$  g of oxygen. Further, when a single substance (as distinguished from a mechanical mixture of several) turns into two or more others—when marble is heated, for instance, or water is electrolysed—it is likewise said to be a compound, and to contain the others.

Except in a few recent publications, only chemical compounds and elements are spoken of as "contained"; brine contains water and salt, but not water and a more concentrated brine; moreover, chemical