12. Rule of multiple proportions.

exactly what gave to Dalton's view its great plausibility,[1] for if the elementary atom of each substance had a definite weight, it might be that not one atom only combined with one other, but that one combined with two, or two with three, and so on. Indeed it was soon found that this was

[1] The different factors of thought which combined to give the atomic theory that definiteness and usefulness which it attained through and since Dalton lay ready-made before him; but no one had seen so clearly as he did how to combine them. Proust had taught how to distinguish between chemical compounds and mixtures. When he prepared carbonate of copper artificially, he found that it had the same composition as the mineral which he found in nature. Richter had shown that definite proportions describe the quantities in which acids and bases exist in neutral salts. Fischer had attached to his translation of Berthollet's work the first table of equivalent quantities of bases and acids which combine to neutralise each other. Richter, and after him Gay-Lussac, had also found that the quantities of different metals which dissolve in the same quantity of acid to form saturated solutions combine also with the same weights of oxygen to form oxides. Richter, and after him Proust, had found that certain metals, like iron and mercury, form more than one fixed compound with oxygen, but without perceiving that the different quantities of oxygen in these fixed compounds stand in simple proportions to each other. So far as the theoretical side is concerned, the idea that bodies are formed of distinct particles—the notion of the ultimate heterogeneousness or discontinuity of matter—was not only familiar to the ancients, but was adopted by many physicists before Dalton; though the chemical specialists who prepared the way for Dalton do not seem to have made use of this idea. Boerhaave, and before him Boyle, had spoken of atoms and of the *massulæ* or particles. Theories were not wanting that these ultimate particles differed in size and form, nor the opposite view, that the particles which combined had the same weight. The latter was the view of Higgins, in the exposition of which (1790) he entangled himself in contradictions, losing his chance of being one of the founders of the atomic theory. As Wurtz and Kopp and others who have carefully investigated the rival claims have said: This honour of founding the atomic theory belongs undividedly to Dalton. It seems important to notice that his experiments with mixtures of gases, which must have begun about 1790, impressed upon him the idea that different gases could exist independently of each other in the same space, suggesting the conception that neither of them filled the whole space, but that they consisted of discontinuous particles. He himself refers to these first investigations as containing the germ of his later opinions. It must, however, be borne in mind that Dalton was only imperfectly acquainted with the writings of contemporary — especially Continental—writers, and that he had a wholesome distrust for statements of facts which he had not verified or observed himself. All this is very clearly stated in Kopp's 'Entwickelung der Chemie,' p. 285, &c.