A great door was now opened, not only for actual observation and research, but also for speculation—*i.e.*, for abstract thought. Some substances, if they entered into combination with hydrogen, required more than one unit of hydrogen, and it might therefore be that the proportion of the combining weight of hydrogen with any substance did not correctly give the atomic weight of the latter, but merely a multiple or sub-multiple of it. Thus, assuming oxygen combined with hydrogen in the proportion of 8 parts of the former to 1 part of the latter, a possibility was that the proportion might more correctly be written 16 to 2 than 8 to 1. Then, again, were the equivalent or atomic weights necessarily whole numbers? Were combinations all binary, such as acids and alkalies forming salts? and were more complex compounds resolvable into binary compounds of simpler binary compounds? Further, assuming the proportions fixing the combining weights to be known, how did the volumes of bodies combine?—was there a rule of volumes as there was of weights? and lastly, what was the reason or cause which made substances change their combinations, forming new ones, what did chemical affinity consist in, what did it depend on, how could it be defined and measured?

Considering that we have to do with a large number of independent, apparently unchangeable, elements, entering into many thousands of differing compounds, the task of

of heat. Lavoisier led the way in the development of the purely arithmetical department of chemistry, in the exclusive study of which physical chemistry was greatly neglected. Dalton suggested a formula which lent itself admirably to the representation of these purely arithmetical relations, and Berzelius elaborated this and invented a practical nomenclature. Black and Dalton threw out novel ideas; Lavoisier and Berzelius elaborated great systems and created great schools which numbered many converts and industrious workers.