

*Philosophy.* He had of course illustrious precursors, notably Antoine-Laurent Lavoisier (1743–1794). Yet his quantitative theory suddenly could explain or predict such a wealth of facts that he may properly be regarded as the founder of modern chemistry. In a sequel volume Dalton expressed the fundamental principle of the youngest of the sciences in these words:

I should apprehend there are a considerable number of what may be properly called elementary principles, which can never be metamorphosed, one into another, by any power we can control. We ought, however, to avail ourselves of every means to reduce the number of bodies or principles of this appearance as much as possible; and after all we may not know what elements are absolutely indecomposable, and what are refractory, because we do not know the proper means of their reduction. All *atoms of the same kind*, whether simple or compound, must necessarily be conceived to be alike in shape, weight, and every other particular.



These superb lines ushered in the intense nineteenth century discussions on the nature of atoms and molecules. Perhaps the most remarkable fact about these debates is the great extent to which chemists and physicists spoke at cross purposes when they did not actually ignore each other. This is not to say that there existed one common view among chemists, another among physicists. Rather, in either camp there were many and often strongly diverging opinions. The principal point of debate among chemists was whether atoms were real objects or only mnemonic devices for coding chemical regularities and laws. The main issues for the physicists centered around the kinetic theory of gases, in particular around the meaning of the second law of thermodynamics.

An early illustration of the dichotomies between chemists and physicists is provided by the fact that Dalton did not accept the hypothesis put forward in 1811 by Amadeo Avogadro (1776–1856) that, for fixed temperature and pressure, equal volumes of gases contain equal numbers of molecules. Nor was Dalton's position held only by a single person for a brief time. The tardiness with which Avogadro's law came to be accepted clearly indicates the widespread resistance to the idea of molecular reality. As but one further illustration of this attitude I mention some revealing remarks by

*John Dalton, whose New System of Chemical Philosophy resurrected the atomic theory of matter. (Courtesy A. L. Smyth, John Dalton: 1766–1844, a Bibliography of Works By and About Him and AIP Emilio Segrè Visual Archives)*