

The Beginnings of the Atomic Theory

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The concept of atom in the theories of the structure of matter is generally traced back, with good reasons, by at least 2 500 years to the time of ancient *Greek philosophers*. But it can most probably be traced back also to much earlier eras, that is, to the more remote ages of the *Hindu philosophers*.

Around the end of the 5th century B.C. the Greek philosopher **Leucippus** and his pupil **Democritus** (460-370 B.C.) remarked explicitly that all material things were made up of small, indivisible things. Eventually, Democritus named these indivisible units as **atoma** (now **atoms** in English language). It is interesting to note that the term atom is derived from the Greek words **a** (= not) and **tomos** (= cut), therefore meaning something that is not divisible. In a more precise way, the Leucippus-Democritus theory stated that matter is homogenous but consists of an infinity of small indivisible particles (or atoms). Moreover, the theory stated also that these atoms are constantly in motion, and through their collisions and regrouping form various compounds. Apart from the statement that matter is homogenous which is not the case in many instances as we will see later, Leucippus-Democritus theory is not only the beginning of the atomic theory but, very importantly, it gives a first known account of what would be developed much later, in our modern times, as the *kinetic theory of matter*.

The atomic concept of Leucippus and Democritus was further supported afterwards by the Greek philosopher **Epicurus** (341-270 B.C.). And yet as late as the first century B.C. by **Lucretius**, a Roman poet and philosopher. Lucretius' famous Latin poem *De Rerum Natura* (= On the Nature of Things) is the fully extant statement of the physical theory of Epicurus. However, the influential Greek philosopher **Aristotle**, who lived from 384 to 322 B.C., raised several objections against the Greek school of atomists that had been initiated by Leucippus and Democritus, with the unfortunate result that the atomistic concepts were disregarded for several centuries. That is to say, till the Renaissance Age in Europe. The atomistic theory was only revived during the sixteenth and seventeenth centuries A.D. by scientists and philosophers as, for example, **Francis Bacon** (England, 1561-1626), **Galileo Galilei** (Italy, 1564-1642), **René Descartes** (France, 1596-1650), **Robert Boyle** (England, 1627-1691), and **Isaac Newton** (England, 1643-1727). *In opposition to the Aristotelian doctrine (or dogma)*, the latter scientists clearly favored the view that matter is not continuous in nature but is made up of particles or atoms instead.

But, one had to wait till the nineteenth century to see the work of the chemists transform the atom from a vague philosophical idea into a true scientific concept, or reality. Initially, this was mostly the result of the work of **John Dalton**, an English schoolteacher who had finished his scholarship at the age of eleven years old. John Dalton had become interested in the subject as the result of his investigations of the solubilities of gases in water and other liquids. In the process, Dalton outlined the bases of the modern atomic theory. His original work, *New System of Chemical Philosophy*, was published in 1808. In this work, Dalton discusses his ideas concerning the atom as the unit of chemical structure.

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