

Mendeleyev's Dream the Quest for the Elements

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Mendeleyev and the Historical Study of Matter

Mendeleyev discovered the periodic table of the elements. This book not only covers Mendeleyev but also develops our understanding and knowledge of the constitution of matter traced back from ancient Greece and onwards. The four elements principle is earth, fire, air, and water, which are crucial constituents of nature and date back from Renaissance humanism to the late Middle Ages and possibly beyond. (Royal Society of Chemistry, n.d.)

Scope and Scientific Narrative of the Book

Mendeleyev's dream outlines a view of the history of chemical compound discoveries. The discoveries are tied to the great philosophers and their view of the four elements. The book consists of many scientists and innovators who have a varied history of chemical and mineral compounds. The author of the book provides the readers with biographies of the people, especially scientists, who helped to shape the idea of the periodic table. (International Union of Pure and Applied Chemistry, n.d.)

Greek Natural Philosophy and the Elements

The first chapter deals with aspects of Greek natural philosophy concerning the structure of matter. In a concise manner, the major ideas concerning the elements of Empedocles, Aristotle, and Plato are discussed.

Alexandrian and Arab Foundations of Alchemy

The second chapter deals with the foundations of alchemy in Alexandria, where the Greek philosophical tradition was blended with Egyptian technology to produce alchemy. Following the decline of Alexandria, alchemy had a rebirth in the new Arab civilization, which spread across the Middle East, North Africa, and parts of Europe. The contributions of the Arab alchemists Jabir, Al-Razzi, and Avicenna are discussed in detail.

Medieval Europe and the Rise of Scientific Thought

The third chapter deals with Europe in the Middle Ages, the emergence of scientific thought, and the conflict with the Roman church. Roger Bacon's ideas are discussed to illustrate this point. The works of the Arab alchemists, having now been translated, were disseminated in Europe, and new discoveries of a practical nature were being made in the context of the age-old attempt to find the mythical philosopher's stone. New laboratory techniques were invented, and old ones were improved upon by the European alchemists. The discovery of new substances is also found in this chapter.

Paracelsus and Early Chemical Medicine

Chapter four reflects the theories, medical practices, and mineral compounds developed by Paracelsus. In his era, Europe was experiencing a new historical era characterized by new scientific inventions. He learned practical and theoretical metallurgy from his father. The theory entails that metals were refined in the ground and transformed from baser forms into silver and then into gold. On the contrary, he developed another theory in which he believed that studying minerals extensively would discover their properties and then be able to provide care for particular diseases. He had extraordinary knowledge of the mineral compound as he was involved in the study of chemical compounds such as zinc and copper salts and compounds of lead and others for treatment purposes. He dedicated most of his time to alchemy and conducted experiments to develop compounds for medicinal purposes. Later in his study, he developed electrochemistry theory, which he believed is the solution to disease since it includes treating diseases with appropriate medicine prepared from mineral sources.

Renaissance Thinkers and the Revival of Atomism

In chapter five, there are particularly interesting discussions of Nicolas of Cusa (1401-1464), who anticipated in many ways Copernicus and Giordano Bruno, whose radical ideas included the revival of the atomism of Lucretius. Galileo, Descartes, Gilbert, and Francis Bacon received ample attention for their philosophical perspectives on the methodology of science. The masterpiece produced by Nicholas of Cusa by applying philosophical, scientific ideas was scientifically pure. This marked the start of the application of a new way of thinking and resolving insoluble problems using coincident oppositum. The scientific revolution in the Renaissance relied upon practical experimental work to achieve results and solve scientific mysteries. Bruno demonstrated that iatrochemistry and discoveries in physics are related and can be combined in the most preposterous way.

Galileo and New Scientific Methods

Chapter six entails a new way of seeing elements. Firstly, Galileo promulgated the elements of science. Galileo realized the full potential of the newly invented penicillin and its commercial probability. His understanding of the new science formed the basis of understanding how things work and the study of matter and the elements. He relied on two models to understand the four elements that had already been discovered. The model included what could be done and how to do it. Through this, Galileo presented a new understanding which combined mathematics and physics to justify the comparison and application and the composition of the four elements.

Gas Chemistry and Quantitative Experimentation

The important discoveries of van Helmont concerning the gaseous state and the use of quantitative methods are stressed. If William Henry Perkin (1838-1907) was responsible for the beginnings of the synthetic organic chemical industry, then, as this book makes clear, it was Heinrich Caro who made it possible for the industry to reach its full potential in the nineteenth century. Carsten Reinhardt and Anthony Travis have not only produced the first complete biography of Caro but have also addressed questions as to what factors enabled the organic chemical industry to grow and prosper in Germany during Caro's lifetime. Following the growth of Caro's employer, BASF, they have also given us insight into what led Germany to become the preeminent chemical manufacturing power in the world. This is a masterfully researched work based upon a wealth of material deposited at the Deutsches Museum of Biochemistry and discusses the experiments that he performed that led to this appellation.

Franciscus Sylvius, a pupil of van Helmont, continued his work and saw digestion as a chemical process involving acids and bases. He was able to extend these ideas to a description of the process of neutralization and the origin of salts. Through his experiments, Sylvius led the way in the distinction between elements and compounds. An interesting anecdote in this chapter, typical of many found in the text, is the origin of the name for the drink gin. As Strathern relates, Sylvius developed a cure for kidney ailments by mixing distilled grain spirit flavored with juniper berries, called in Dutch genever. Although it failed as a cure-all, it became a popular drink and, in English, was abbreviated to gin. Science was undergoing transitions, and the changes and influences were widely felt in the realms of chemistry. Jan Baptista van Helmet- a physician and a scientist, was born in 1580 and termed himself a philosopher by fire as he believed that all knowledge was God's gift. During this period, there were wide distinctions and conflicts between science and religion. Van Helmont's mentor was Paracelsus. He once claimed that he had found a 'stone' that contributed to his transmutation process. In one of his successful experiments, he intercepted biology with chemistry and came up with biochemistry. In another experiment, he drew wrong conclusions, which, in turn, led to major scientific developments. He linked water movement to air form, where he began extensive research on air. He also grasped the alchemist's idea of other "airs" and their distinction from water vapors. He burned 62 lb of charcoal, which released identical water vapors but distinct properties from where he concluded that the charcoal contained 6 lb of carbon dioxide gas.

Acid-Alkali Theory and Chemical Classification

Most scientists rose in the Renaissance period. For instance, tachinid felt that acid and alkali were two principles that subsumed all chemical reactions. Acid effervescences with an alkali. Through scientists such as Helmont, Sylvius, and Tachenius, chemistry began to transform into a distinct science. Torricelli rose after the death of von Helmont and invented the first barometer. He also discovered space, and through this, gases were the same as solids and liquids as they all had weight. Ultimately, these discoveries in science had a large impact on science transformation. For instance, the alchemist led to lunacy in chemistry and all elements at large. In this era, Newton,

Discovery and Definition of Chemical Elements

In this chapter, nine elements had already been discovered, and three were discovered in the late Middle Ages. In 1661, Boyle defined elements as substances that could be broken down into simpler substances. New elements were introduced, including phosphorus (first isolated from human urine), barium, nickel, molybdenum, chlorine, and platinum, and hence a great memory in the history of chemistry. New discoveries that had not been seen before came into existence due to the extensive research carried out by various scientists. For instance, Newton introduced new versions of calculus. Karle Scheele found out that phosphorous was found in bones; he also found many more elements than any other scientist.

Phlogiston Theory and Seventeenth-Century Chemistry

In chapter 9, for several centuries, the phlogiston mystery has existed since Greek times. It was, however, explained by the use of the four elements, but in the 2nd half of the 17th century, a new theory came into existence and came to be accepted by many scientists. Combustion was believed to be due to the phlogiston(a fire-producing substance contained in materials like wood).

Lavoisier and the Chemical Revolution

New experiments were carried out by chemist Lavoisier, who was against the phlogiston theory due to the discovery of oxygen. Priestley showed his dephlogisticated air. Here, Lavoisier has greater knowledge of chemistry. He was guillotined in the revolution, while Priestley believed in phlogiston.

Dalton's Atomic Theory and Gas Laws

In this chapter, Dalton- a meteorologist, decided to turn his attention to chemistry. He supported Boyle's notion that gases comprise particles, and in turn, he came up with the Dalton law, which stated that when two or more gases are mixed, their combined pressure will be equal to the added pressure. He also discovered atoms used to explain the Proust law. Dalton's atomic theory stated that all elements are comprised of indestructible atoms. Dalton also discovered hydrogen from water. In 1777, Louis Joseph introduced another property of gases. He stated that all compounds are comprised of elements in simple definite ratios by weight. The new systematic approach and new experiments led to the discovery of new elements, such as sodium.

Mendeleyev and Periodic Classification

In the final chapter, It became apparent to most chemists that there was an order in the properties of the elements as well as the atomic weights. However, the attempts to introduce a clear pattern failed consecutively. In this final chapter, Strathern explains how Mendeleyev solved puzzles due to his desired dream. The periodic table did not gain acceptance worldwide, but Mendeleyev was able to predict the hitherto unknown elements, which were later discovered in correspondence with his impressive accuracy- clear anticipation of Karl Popper's falsification principle. (Royal Society of Chemistry, 2019)

Critical Evaluation of the Final Chapters

In conclusion, the last four chapters are the most disappointing. In a scant 70 pages, the author takes up the Chemical Revolution, Dalton, and the atomic theory, the work of Berzelius and Davy, as well as the early attempts at the periodic classification of the elements. In the last chapter, he returns to Mendeleyev in more detail. For the casual reader, there is sufficient material to give a flavor of this crucial era in these four chapters. *Mendeleyev's Dream* has more details about the earlier practice of alchemy and the lives of the people. His is a readable, if slightly tendentious, account of the development of our modern understanding of the nature of matter. Strathern misses out on some good stories, such as an apparently convincing demonstration of transmutation witnessed by Helvetius in the seventeenth century, nor does he mention the strange story of the Rosicrucian Manifestos, which are thought to have influenced the thinking of both Boyle and Newton and to have played a part in the origins of the Royal Society. However, the book provides an adequate overview of its subject, and the characters and backgrounds of the principal figures in the story are well described.

References

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