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Chemistry and History

Early American Chemistry Books For Children

William D. Williams
Harding University
Searcy, Arkansas 72149-0001
wwilliams@harding.edu

These books provide a quaint insight into the society as well as the science of the nineteenth century.

A surprising number of early American chemistry books were written for children. While most were at an intermediate level, this paper reviews three that were written for the early grades. These books provide a quaint insight into the society as well as the science of the nineteenth century. Since they were small and cheaply made, only a few copies have survived. Figure 1 contains black and write reproductions of the title pages as well as a color photograph of the three books. To illustrate their style, several pages of each are available in the supporting files: lady.pdf (178 Kbytes), davy.pdf (974 Kbytes), and green.pdf (318 Kbytes).

The early American spirit of inevitable progress was as wide as the new United States itself. The faith that society could “lift itself by its bootstraps” prompted an emphasis on applied science. Independence from Europe, conquering the west, and utilization of natural resources created a demand for technical education. Public lectures on science were eagerly attended by adults. Colleges replaced classical studies with practical subjects. Chemistry became a standard course in academies and high schools.

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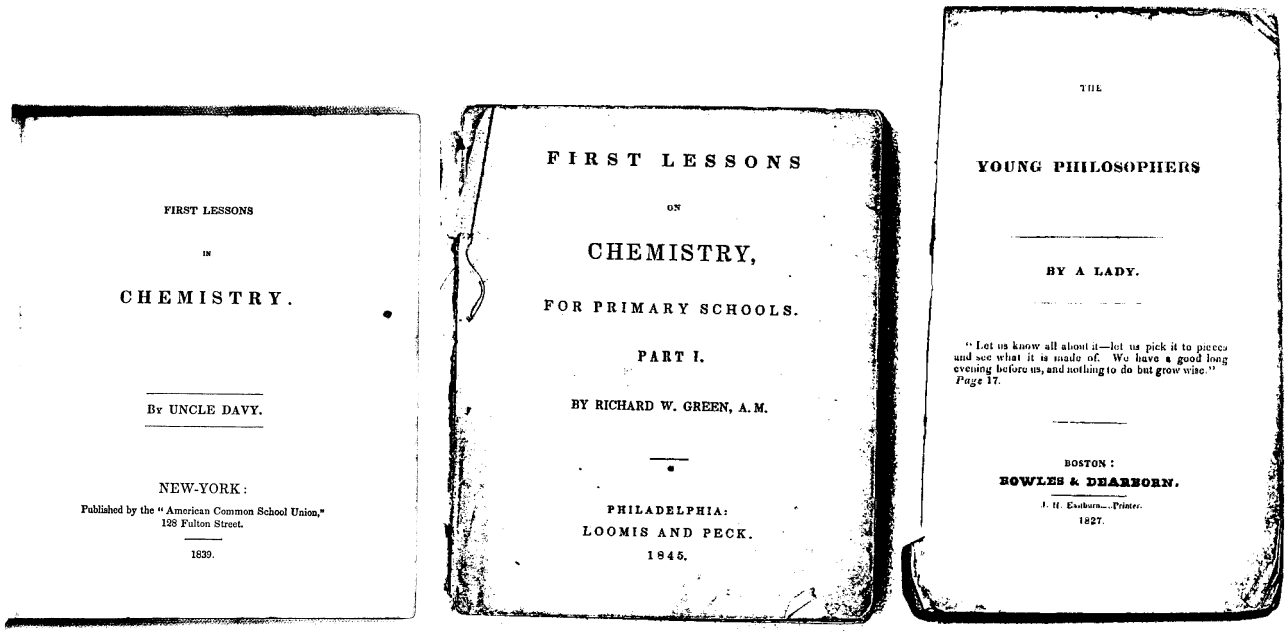

FIGURE 1. TITLE PAGES (BELOW) AND PHOTOGRAPH (ABOVE) OF THREE EARLY AMERICAN CHEMISTRY BOOKS FOR CHILDREN.

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Since a majority of students did not attend high school, science was also added to the common (elementary) school. Juvenile chemistry books were published, not only for the classroom, but also for home family reading.

The Young Philosophers [1], published in 1827 by an anonymous "Lady," was written for home reading. It measures 9 x 15 cm and is bound with printed paper double thickness. The 60 pages contain no illustrations and are in the format of conversations between members of a family — young Lucy, her mother and father, and her older brother, Edward. Since the word "philosopher" at that time meant the same as "scientist" in modern language, this story presents children learning some principles of science from everyday observations. They discuss simple concepts of heat — evaporation and condensation, expansion and contraction, and boiling and freezing.

This quote from the title page gives the tone of the book:

> "Let us know all about it — let us pick it to pieces and see what it is made of. We have a good long evening before us, and nothing to do but grow wise."

In that era of simple lifestyle, the author encouraged families to use quiet times for the education of the children. The mother taught Lucy to communicate by having her relate the stories she had been reading and give an opinion of the characters in the story. Similarly, she encouraged Lucy to explain scientific concepts in her own words.

Most of the examples in this book involved physical changes: water expanding to overflow a heated kettle; freezing water bursting a glass; formation of dew, frost, and breath vapor. The main chemical topic is the presentation of matter as molecular. Without the use of a scientific vocabulary, the book presents materials as made up of very minute particles. Lucy learned that heat expansion was due to greater separation of the particles and that a solution was a mixing of solid particles among the water particles. Perhaps the author intended further volumes on other topics, but none has been located.

As is true of many books from this period, this little volume contains some moralizing. The author praises the ideal character traits that she gives to her characters. She admonished her readers to be "good children," "show happiness," "have respect for elders," "study hard," "be thankful for opportunities," and to "recognize the wisdom of the Creator."

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First Lessons in Chemistry [2] by Uncle Davy was titled to take advantage of the popularity of Sir Humphry Davy, whose *Elements of Agricultural Chemistry* was widely known in the United States. It was written and copyrighted by James Hyatt in 1839. Measuring 11 x 13 cm, it contains 94 pages and is bound with printed paper on cardboard. It is illustrated with nine small woodcuts of apparatus and a full-page frontispiece showing a mine scene and Davy with his safety lamp.

In a question and answer discussion between a child and an adult, the book presents a very simple survey of chemistry. Twenty-six numbered lessons, of 2 to 4 pages each, are titled: Heat, Caloric, Electricity, Conductors, Air, Oxygen, Combustion Experiments, Nitrogen, Hydrogen, Hydrogen Experiments, Water, Sulfur, Vitriol, Phosphorous, Carbon, Carbonic Acid Gas, Safety Lamp, Iron, Magnets, Zinc, Tin, Copper, Lead, Paint, Mercury, and Silver. Hyatt's preface explains:

> My young friends: I here send you some lessons, which if you read carefully, will be useful and amusing. You can find out from them many strange and curious things that in old times were unknown to the wisest men, and so you may know something more than your grandfathers, yet for all that you need not think of yourselves wiser than they until you are older and more experienced...I have put in this little book (that you can all afford to buy), such things as can only be found in large volumes; and I hope that you will be wiser and happier when you have read them.

The adult and the child discuss the topics and carry out experiments in the same style as the modern TV scientist, "Mr. Wizard." Their apparatus ranges from household items (tea kettle, iron bands on wagon wheels, and dyes) to specialized laboratory equipment (hydrogen–oxygen compound blowpipe, flasks, crucibles, and Argand lamp).

Some statements would be quite at home in today's classroom:

> "When the name of the acid ends in ic, that acid contains more oxygen than when the name ends in ous."

> "A simple substance [meaning element] is one that cannot be separated into several others."

> "What is the quality of being hammered into different shapes called? Malleability. What is the quality of being drawn into wire called? Ductility."

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Other statements are incorrect or simplistic: the word “mixture” is used where today’s chemist would use “compound” or “combination.”

> “What makes the lightning-bug and the glow-worm shine in the night? It is an animal substance that contains a large quantity of phosphorous.”
>
> “How heavy is lead? About eleven times as heavy as water.”

The book also contains some terms no longer used. Zinc oxide was called “white nothing.” “Spunk” was carbonized rags used in tinder boxes. “Jack-of-the-lantern” referred to spontaneous fires from decaying organic matter in swampy places. A “shivered” tree was one split by lightning.

Two unusual devices for producing fire are discussed. The “fire gun” was a tube, sealed on one end and fitted with a pump piston on the other. Spunk tinder was put into the sealed end and ignited as the air was heated by compression, or as Hyatt explained, “the caloric is forced out of the air and the tinder set on fire.” The second apparatus, the “hydrogen jar,” produced a jet of hydrogen gas which ignited as it came in contact with spongy platinum. This device, which turned on and off like a modern cigarette lighter, was used in the home as well as the laboratory before the invention of matches.

Hyatt’s simple little book must have served a need, since a seventh edition was published in 1846.

James Hyatt (1817–1904) was an educator in New York state. Between 1860 and 1870, he is said to have “averaged twenty lectures a week in sixteen schools and colleges, besides holding the chair of chemistry and toxicology in the Woman’s Medical College” [3]. He also wrote a college level chemistry text, *The Elements of Chemistry* (1855) [4]. He was an early member of the American Association for the Advancement of Science and the New York Lyceum of Natural History (later the Academy of Sciences) and was one of the founders of the Torrey Botanical Club in New York. The only detail known of his early career is that he taught at Mt. Airy Agricultural Institute in Mt. Airy, Pennsylvania during the late 1840s.

First Lessons on Chemistry, for primary schools, Part I, by Richard W. Green [5] is quite similar to Hyatt’s book. Published in 1845, it is arranged in the same question and answer format and contains similar short, numbered lessons. Its 108 pages,

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measuring 11×14 cm, are bound with printed paper on cardboard. The book cost twenty cents. It is illustrated with one full page and several small woodcuts. The contents lists 33 lessons: Fire, Friction, Percussion, Equilibrium, Radiation, Conduction, Conductors, Reflection, Fusion, Vapor, Convection, Combustion, Combustibles, Supporter of Combustion, Decomposition, Elements, Affinity, Air, Evaporation, Oxygen and Nitrogen, Water, Hydrogen, Oxides and Acids, Carbon, Carbonic Acid, Sulfur, Phosphorus, Nomenclature, Carburets, Alkalies, Earth's, Metals, and Carbonates.

Green explained the philosophy of the book:

> "The practical spirit of the present age has, as with a giant hand, marked out new requirements in education, and new methods of instruction. And where formerly we found the memorizing of abstruse principles which were intended for usefulness when the mind should be developed; we now meet with experimental fact, designed for present intellection and immediate application. The mind has become operative; and not only is there a habit of inquiry among our adult population, but the younger portion of the community seem to have caught, or inherited the same spirit; which they manifest by wishing to know the why and wherefore of all they observe around them. This spirit has been happily met by the modern discovery, that the science of common things may be so explained as to be understood by the juvenile mind."

While the discussions are quite elementary, this book presents a good survey of chemistry. A second part was apparently never published. In the preface, Green announced intentions to write a series of similar science books, each in two parts. Since others did not follow, his *First Lessons on Chemistry* must not have been widely accepted.

No biography of Green has been found. He had an A.M. degree and apparently was a teacher. From 1829 to 1850, he wrote eight elementary texts on mathematics and grammar, some of which went through several editions.

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5. Green, R. *First Lessons on Chemistry, for primary schools. Part I*; Loomis and Peck: Philadelphia, 1845. (The only known surviving copy is in the John A. Nietz Collection at the University of Pittsburgh Library. The author wishes to thank the Library for providing photocopies.)