

19th century

textbook illustrations



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The Synthesis and Analysis of Water

The illustrations show rather romanticized 19th century versions of Macquer's synthesis of water by burning hydrogen in air (left) and Lavoisier's decomposition of water by passing steam over hot iron (right).¹ Although Macquer appears to have described the hydrogen combustion experiment in 1781, it was Cavendish, who independently did the experiment the same year—and especially Lavoisier, who supplemented it with his decomposition experiment—who first recognized its true significance.

Asimov argued several years ago in a popular essay that the synthesis of water came as close as anything to being the single crucial experiment which finally decided the chemical revolution in favor of Lavoisier's system.² The phlogistonists maintained a "modification theory" of gases which viewed all gases as variations of a single gaseous base produced by its combination with varying amounts of phlogiston. At one end was oxygen which contained the least amount of phlogiston and at the other end was NO which contained the most. In between were the other gases, such as carbon dioxide and nitrogen, which contained intermediate amounts of phlogiston.



Lavoisier, on the other hand, viewed each gas as a distinct species. They were merely the gaseous state of some solid or liquid substance produced by the addition of caloric. Gases were not interconvertible by altering a common constituent like phlogiston.

According to the phlogistonist model the combination of hydrogen, which was thought to be nearly pure phlogiston, with oxygen should give a gas of higher phlogiston content such as carbon dioxide or nitrogen. The fact that it gave water instead was totally inexplicable. Historians of science are now beginning to view the chemical revolution as a conflict between alternative models of composition—the problem of combustion itself playing only a secondary role.³ Indeed, an entire thesis dealing with the compositional aspects of the chemical revolution has recently been written.⁴

¹ Routledge, R., "A Popular History of Science," G. Routledge & Sons, London, 1881, pp. 357, 375.

² Asimov, I., "Asimov on Chemistry," Doubleday & Co., Garden City, New York, 1974, pp. 20–34.

³ Siegfried, R., and Dobbs, B. J., *Annals of Science*, XXIV, 275 (1968).

⁴ Langer, B., "Pneumatic Chemistry, 1772–1789: A Resolution of Conflict", Ph.D. Thesis, University of Wisconsin, 1971.

