Abhandlungen, 2 vols. (Leipzig, 1910–1911). He summarized his contributions and their place in the field in other books: *Das Leitvermögen der Elektrolyte, Methode, Resultate, und Anwendungen* (Leipzig, 1898) and *Die Energie oder Arbeit und die Anwendungen des elektrische Stromes* (Leipzig, 1900).

The first eight eds. of his laboratory manual were entitled *Leitfaden der praktischen Physik* (1st ed., Leipzig, 1870), while the 9th through the 16th eds. were published under the title *Lehrbuch der praktischen Physik* (9th ed., Leipzig, 1901). The memoir in which Kohlrausch stated his final conclusions with respect to conductivity and ions was "Ueber das Leitungsvermogen der in Wasser gelosten Electrolyte in Zusammenhang mit der Wanderung ihrer Bestandtheile," in *Göttingen Nachrichten* (1876), p. 213; it was republished in Harry Manly Goodwin, *The Fundamental Laws of Electrolytic Conduction* (New York–London, 1899), with memoirs of Faraday and Hittorf.

II. Secondary Literature. For discussions of Kohlrausch's work on conductivity of solutions, see Wilhelm Ostwald, *Elektrochemie, ihre Geschichte und Lehre* (Leipzig, 1896), or Harry C. Jones, *The Theory of Electrolytic Dissociation and Some of its Applications* (New York, 1900).

Ollin J. Drennan

KOHLRAUSCH, RUDOLPH HERRMANN ARNDT (*b.* Göttingen, Germany, 6 November 1809; *d.* Erlangen, Germany, 9 March 1858), *physics.*

Kohlrausch is best remembered for showing, with Wilhelm Weber, that the ratio of the absolute electrostatic unit of charge to the absolute electromagnetic unit of charge equals the speed of light.

Kohlrausch taught mathematics and physics, successively, at the Ritterakademie at Lüneburg, the Gymnasium at Rinteln, the Polytechnikum in Kassel, and the Gymnasium at Marburg. He became professor at the University of Marburg in 1853 and at the University of Erlangen in 1857, a year before his death. Kohlrausch was the father of the physicists Friedrich Wilhelm Kohlrausch and Wilhelm Friedrich Kohlrausch and the grandfather of the physiologist Arnt Ludwig Friedrich Kohlrausch.

Kohlrausch improved the operation of the Dellmann electrometer (1847–1848) and measured the electromotive force of various cells (1849–1853). He verified Ohm's law in electric circuits in 1848 when he showed that the electromotive force produced by a cell was proportional to the electroscopic tension of the same cell.

In 1856 Kohlrausch and Weber used the tangent galvanometer, developed by Weber, to determine experimentally the electromagnetic value of the discharge current when a Leyden jar is discharged through the galvanometer. They compared this value with the value, determined experimentally, of the electrostatic charge contained in the Leyden jar before discharge. Kohlrausch and Weber found that the ratio of the two measurements—electrostatic to electromagnetic—equalled 3.107×10^{10} cm. sec., a figure close to the accepted value for the velocity of light. This result was the continuation of Weber's measurements, with Gauss, of the absolute units of terrestrial magnetism.

The coincidence of the ratio and the speed of light led Kirchhoff to state in 1857 that an electric disturbance was propagated along a perfectly conducting wire at the velocity of light.

BIBLIOGRAPHY

Kohlrausch's works have not yet appeared in collected form. Original articles can be found in various journals, including Poggendorff's *Annalen der Physik und Chemie*, in which the major paper with Weber, "Ueber die Electricitätsmenge, welche bei galvanischen Strömen durch den Querschnitt der Kette fliest," was published (**99** [1856], 10–25). It was reprinted with Friedrich Kohlrausch's paper on conductivity of solutions, in *Ostwald's Klassiker der exakten Wissenschaften*, **142** (1904).

Ollin J. Drennan

KOLBE, ADOLF WILHELM HERMANN (*b.* Eliehausen near Göttingen, Germany, 27 September 1818; *d.* Leipzig, Germany, 25 November 1884), *chemistry.*

Hermann Kolbe was the oldest of fifteen children of a Lutheran pastor and was raised in the towns of Eliehausen and Stockheim, in the vicinity of Göttingen, where his father held pastorates. His mother, Auguste, was the daughter of A. F. Hempel, professor of anatomy at the University of Göttingen. Kolbe showed an early interest in science. When he entered the Göttingen Gymnasium, at the age of fourteen, he was introduced to chemistry by a fellow student who had studied this subject with Robert Bunsen, then a privatdocent at the university. Kolbe later said that this encounter led him to choose chemistry as his career. In 1838 he entered the University of Göttingen, where Wöhler had recently begun to teach chemistry. While he was a student he met Berzelius, who was visiting Wöhler, and was deeply impressed by him; Berzelius later took a great interest in Kolbe's first major research. It is not surprising that the young chemist accepted Berzelius' theories wholeheartedly and founded his later theoretical ideas upon them.

In 1842 Kolbe published his first short paper, on fusel oil, and began work on his doctoral dissertation. While this dissertation was in progress he was offered