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This Week's Citation Classic

Kell G S. Precise representation of volume properties of water at one atmosphere. *J. Chem. Eng. Data* **12**:66-9, 1967. [Division of Applied Chemistry, National Research Council, Ottawa, Canada]

The data for ordinary water and the isotopic varieties were correlated for the temperature ranges for which experimental values were available. The correlations were reported in tabular and functional form. [The *SCI*® indicates that this paper has been cited over 140 times since 1967.]

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"According to Cyrus H. Gordon, the American archeologist and philologist, a scholar should turn out useful publications that will help other scholars in their work. The present paper, which I value particularly as it was the first paper on which my name appeared as sole author, provided a correlation based on a careful treatment both of the estimation of the experimental error of the data, some from our laboratory, and of the mathematical problems of finding a suitable functional form. For some years these values appeared in the Handbook of Chemistry and Physics,[1] under my name but without reference to the journal, so they have been used more than the number of citations would indicate. From one perspective, high-precision density measurements and their correlation may seem dull, but they present a real challenge and are a prerequisite for high-precision thermodynamics and hydrodynamics.

"In evaluating the data, scholarly aspects of science came to the fore. Papers in several languages and over many decades were read—a paper of 1839[2] was cited as probably having modern value—and it was necessary to allow for the evolution both of the precision with which the various measurements could be realized and of the names by which they were distinguished.

"The publication of new data and reanalysis of the errors of the data led to revised correlations. For example, with the adoption of the International Practical Temperature Scale of 1968 it became clear that the earliest international scale, the Echelle Normale, the scale on which the most reliable early measurements were made, has been irretrievably lost to the sprecision with which it was once realized. Another major unknown in the earlier work (as in much modern work) is the isotopic composition to which it relates. Such considerations have led to subsequent papers superseding the present one[3,4] In addition, considerations of the experimental errors of density determinations have led to results on the propagation of error which, alas, I have not yet phrased in a way that seems convincing to journal editors "

1. *Handbook of Chemistry and Physics*. Cleveland: CRC Press. (**Weast R C** ed.) 50th edition, 1969-70, to 56th edition, 1975-76. p. F-5.
2. **Despretz C.** Recherches sur le maximum de densite de l'eau pure et des dissolutions aqueuses. *Ann. Chim. Phys. Paris* **70**:5-81, 1839.
3. **Kell G S.** Density, thermal expansivity, and compressibility of liquid water from 0° to 150° C. *J. Chem. Eng. Data* **20**:97-105, 1975.
4. ..... Effects of isotopic composition, temperature, pressure, and dissolved gases on the density of liquid water. *J. Phys. Chem. Ref. Data* **6**:1109-31, 1977.