

Book Review: *The Theory of Thermodynamics*

The Theory of Thermodynamics. J. R. Waldrum. Cambridge University Press, 1985.

This new book on statistical mechanics and thermodynamics is meant for undergraduate physicists and will compete well with such standard textbooks as *Statistical and Thermal Physics* by F. Reif (McGraw-Hill, 1965) and *Thermal Physics* by C. Kittel and H. Kroemer (W. H. Freeman, 1980). It will not, as a rule, be of interest for undergraduate chemists because American chemistry curricula usually integrate these topics into a general physical chemistry course.

The style of the book is very appealing: informal, first-person narrative, helpful marginal notes, and short, readable chapters. The development of the edifice of statistical mechanics and the subsequent derivation of bulk thermodynamic properties, all from carefully presented statistical arguments, is elegantly done. The basic concepts of the master equation, ergodicity, and detailed balance are made crystal clear. The second law is derived from the statistics of energy changes in a way that is much more straightforward and satisfying than the thermodynamic argument using the Carnot cycle. (Did we physicists and chemists not all detest the Carnot cycle as students? As teachers?)

Once the principles are established, the usual kinds of elementary applications are considered. More advanced applications include the second virial coefficient, some ideas about liquids, and electrical and magnetic systems. Then there follows an introduction to the kinetics of the approach to equilibrium: fluctuations and transport properties. A chapter on phase transitions is quite up-to-date, including a "taste" of the renormalization group theory of critical phenomena. The last chapter is a philosophical discussion of the fundamental assumptions.

There is a useful set of suggestions for further reading and reference. There are problems provided for most chapters, but not enough (about 100 for the whole book).

The beautiful way in which the principles of thermal physics are developed is the strength of Professor Waldrum's book and I recommend it to you for this reason.

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