

## **Book Review: *Thermal Physics***

**Thermal Physics.** Ralph Baierlein, Cambridge University Press, Cambridge, 1999.

This book is intended to be a text for upper-level physics and astronomy students in a one-semester course on thermal physics. In many ways, the book fulfills this intention admirably.

The arrangements of topics is novel since, after some preliminaries, it starts with entropy and the second law, moves on to the canonical probability distribution, and then to the chemical potential. These techniques are applied to photons and phonons, the quantum ideal gas, free energies and chemical equilibrium, phase equilibrium, and critical phenomena. In Chapter 13, the classical limit is discussed and then applied to transport process in dilute gases. There is a very nice discussion of the third law and approaching absolute zero in Chapter 14. Each chapter has a set of problems at the end which range from simple to thought-provoking applications of the material.

Most of the thermodynamic concepts introduced are presented well—especially the concept of reversible processes. On the other hand, the discussion of thermal equilibrium needs more care. It is not sufficient to have time independence; it is necessary to add the fact that there are no fluxes in the system and that the state has to be attainable from all directions. For upper-level students, the concepts of partial derivatives should be well known, but the author tends to shy away from using these derivatives. It would have been useful to introduce the concepts of components in the discussion of the Gibbs phase rule on p. 209.

In Chapter 2, the relationship of entropy to multiplicity is introduced, and this relationship is used throughout the book. While this relationship is a valuable intuitive guide, some care must be taken in its application. It is relatively easy to compute multiplicity for ideal systems. For real systems, the effects of intermolecular interactions must be taken into account.

Despite the points raised above, I enjoyed reading this tremendously. The author has a personal and thoughtful way of introducing and arranging

the material. He has succeeded in making many of the difficult concepts more intuitive and more within the grasp of students who have very little background in thermodynamics and-thermal physics.

In the hands of a skilled teacher, this book would serve very well in its intended role.

Irwin Oppenheim  
*Chemistry Department*  
*Massachusetts Institute of Technology*  
*Cambridge, Massachusetts 02139*