author in the Preface, he does not use the modern definition of heat (Born), and I found the introductory definitions on page 12 of heat and work imprecise. There is a good treatment of the second law of thermodynamics following the Carotheodory approach. There is essentially no chemical thermodynamics in the text. There are a number of interesting historical footnotes at least partly intended to give Russians credit for ideas which they are not generally credited with in the West.

In general, I found the text somewhat superficial because too many topics were treated in the 227 pages, and I do not think the book will be useful either for teaching thermodynamics or for those who want to refresh their memory of thermodynamics.

Order-Disorder Phenomena. By H. S. Green and C. A. Hurst. 352 pp. Interscience, New York, 1964. $15.00.
Reviewed by Carl Garland, Massachusetts Institute of Technology.

The title of this monograph would suggest a rather general review of the order-disorder problem, but the text is actually restricted to a few closely related theoretical topics with special emphasis on the Ising model for two-dimensional lattices. Indeed, there is only a very brief account of approximate theoretical methods, which seems to reflect the authors' own interest in exact solutions and their feelings about the uncertain character of inexact solutions. ("Generally, approximate methods give a poor and even misleading account of the transition between the ordered and disordered phases.") It is obvious that two-dimensional Ising models are very crude representations of physical systems. In spite of this, their mathematical tractability and the fact that they do simulate an order-disorder cooperative transition give them a special importance and interest. Within the restricted but challenging scope of exact solutions to the two-dimensional Ising problem, the authors have given a clear and authoritative presentation. In particular, they give an easily understandable derivation of the analytical results for a rectangular lattice with nearest-neighbor interactions.

About half of the text will be of interest to the general reader. Chapter 1 quickly reviews the principles of statistical mechanics and then formulates the Ising problem in detail. Although no experimental work is discussed, Chapter 2, on applications, does summarize in broad terms the interpretation of experimental results in ferromagnetism, antiferromagnetism, binary alloys, and melting phenomena as a background for the subsequent theoretical discussions. Chapter 3 is devoted to a detailed analytical treatment of the rectangular lattice. The evaluation of the Ising partition function is reduced to a combinatorial problem which is then solved by the relatively simple device of introducing for each lattice point a set of "terminals" and counting the number of different ways of pairing them. It follows that the partition function is directly related to a Pfaffian $\diagdown D|$, and rules for forming the elements of $\diagdown D|$ are given. The Pfaffian technique, which has been developed recently by Green and coworkers, makes possible a simpler presentation of the theory of this problem than does Onsager's beautiful, but complex, algebraic approach. Indeed, a simplification of Onsager's original method is reviewed in Chapter 6, together with the Kac-Ward combinatorial method as extended by Sherman.

The remaining chapters concern the generalization of the method to provide more powerful techniques of generating the Pfaffian and illustrate the general method by consideration of several special lattices, including triangular and hexagonal plane networks. Although the Pfaffian technique has been successfully applied to a wide range of two-dimensional problems, it appears to fail in a number of important cases (as do the Onsager or Sherman approaches). Chapter 7 shows that exact solutions cannot be obtained for a rectangular lattice with second-neighbor interactions, for a three-dimensional lattice, or for a lattice in a magnetic field. These outstanding problems show that while the Pfaffian technique is valuable for the more efficient formulation of soluble problems it does not reduce the class of currently insoluble ones.

For the reader who is not already familiar with Onsager's exact results but does know some of the approximate results obtained by the Bragg-Williams or Bethe method, this book has an unfortunate shortcoming. One is left to admire the solutions only in terms of analytical expressions. The graphical presentation of a few numerical examples of the variation of (say) energy and heat capacity with temperature for an exact solution to the Ising model as compared with various approximate solutions would dramatize the difference between these results in the transition region.

Radio Ray Propagation in the Ionosphere. By John M. Kelso. 408 pp. McGraw-Hill, New York, 1964. $17.50.
Reviewed by H. J. Hagger, Albiswerk, Zurich, Switzerland.

Ionospheric research is an old interest in radio physics and goes back to Marconi's days. For a long time these investigations could only be done from terrestrial ground stations, and radio ray propagation and reflection served as a tool to support theoretical work. In more recent years space stations have been used as unmanned experimental stations, providing data on geomagnetic fields, ionization density, and measurements of primary rays from outer space. The discovery of the Van Allen Belts has shown that the terrestrial atmosphere is of particular importance in space flight.

This book intends to bring the theory of the propagation of electromagnetic waves in the ionospheric layers closer to reality. After a short outline of the history, the author deals with electromagnetic propagation in a homogeneous medium to achieve a basis for the remainder of the book. In the next chapter the physics of the ionosphere is treated, considering also aurorae, meteors, and disturbances in these layers. The basic equations suitable for the propagation of radio waves in an ionized, absorbing medium are presented in several different forms adjusted to specialized uses. In this chapter the presence of the earth's magnetic field is assumed. In chapter 5, on ray theory, the magnetic field