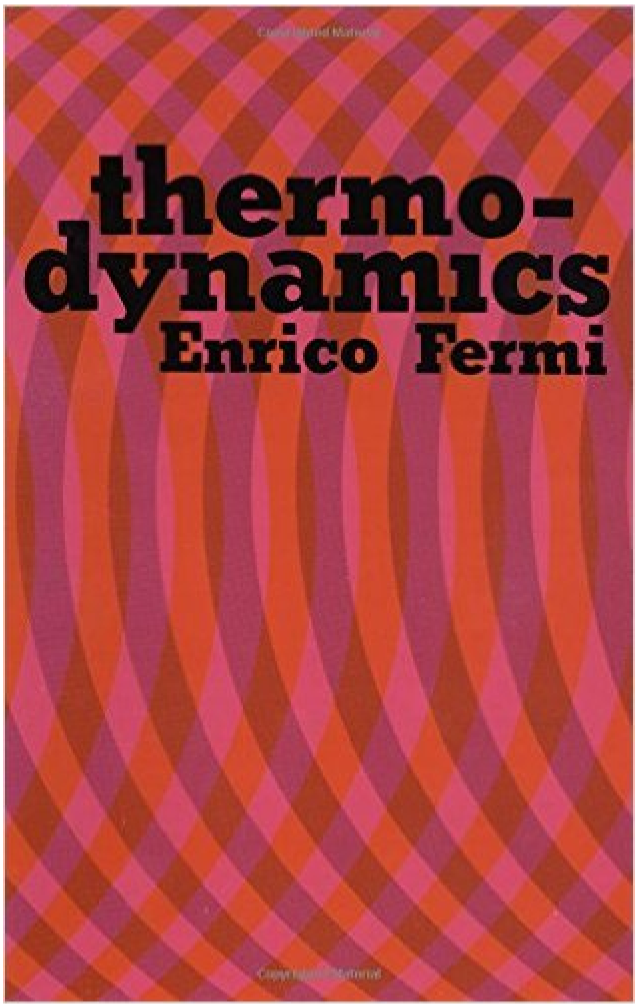
Thermodynamics (Dover Books On Physics)



Synopsis

Indisputably, this is a modern classic of science. Based on a course of lectures delivered by the author at Columbia University, the text is elementary in treatment and remarkable for its clarity and organization. Although it is assumed that the reader is familiar with the fundamental facts of thermometry and calorimetry, no advanced mathematics beyond calculus is assumed.Partial contents: thermodynamic systems, the first law of thermodynamics (application, adiabatic transformations), the second law of thermodynamics (Carnot cycle, absolute thermodynamic temperature, thermal engines), the entropy (properties of cycles, entropy of a system whose states can be represented on a (V, p) diagram, Clapeyron and Van der Waals equations), thermodynamic potentials (free energy, thermodynamic potential at constant pressure, the phase rule, thermodynamics of the reversible electric cell), gaseous reactions (chemical equilibria in gases, Van't Hoff reaction box, another proof of the equation of gaseous equilibria, principle of Le Chatelier), the thermodynamics of dilute solutions (osmotic pressure, chemical equilibria in solutions, the distribution of a solute between 2 phases vapor pressure, boiling and freezing points), the entropy constant (Nernst's theorem, thermal ionization of a gas, thermionic effect, etc.).

Book Information

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Customer Reviews

These lectures by Enrico Fermi make great reading for undergraduates in chemistry or physics, particularly those undergoing the rigors of physical chemistry and chemical thermodynamics. Fermi writes with clarity, always carefully laying the appropriate groundwork for each topic.The mathematics assumes familiarity with calculus, including partial differentiation. Fermi provides clear explanations and motivation for the mathematics and the derivations are complete and easy to follow. For example, he carefully explained the form of a perfect differential of two variables and how it can be more readily integrated. I appreciated this help.The first four chapters will be familiar to students of physics: Thermodynamic Systems, First Law of Thermodynamics, Second Law of Thermodynamics, and Entropy. The derivation of the Clapeyron equation and the Van der Waals equation may be new to some students.Thereafter, the text begins to look more like physical chemistry with chapters titled Thermodynamic Potentials, Gaseous Reactions, Thermodynamics of Dilute Solutions, and the Entropy Constant. I found these last chapters to be more difficult, but not overly so.At some points Thermodynamics becomes a real page-turner, but not in the sense of a fast-paced action story. The page-turning is necessary to retrieve earlier mathematical expressions. Occasionally, you will encounter statements like "the expression for the free energy is immediately obtained from equations (111), (29), and (86)." Fermi does not allow the reader to forget earlier derivations and discussions.If your familiarity with thermodynamics is limited (or now foggy due to the passage of years), I suggest first reading Understanding Thermodynamics by H. C. Van Ness. This 100-page book, a series of lectures, is an excellent introduction to thermodynamics from an engineering and physics perspective. It corresponds to the first four chapters of Fermi’s text.

This slim volume is based on a course of lectures given by Fermi at Columbia University, New York, in the summer of 1936. The intended audience for this book is clearly the science undergraduate, but given the age of this text, one wonders whether it is more of historical interest than a course book for the modern student.Fermi’s treatment of the fundamentals in the first four chapters - thermodynamic systems, the first law, the second law, and entropy - is attractive in its clarity. He takes his time, and is careful not to lose the reader as he elaborates the concepts. Given the timeless nature of these topics, this part of the book does not suffer on account of its age.Regarding the subjects presented in the next three chapters - thermodynamic potentials, gaseous reactions and the thermodynamics of dilute solutions - my view is that today’s student would be better advised to study a more contemporary text. Important equations, such as the Gibbs-Helmoltz equations, are not mentioned here, and some of the nomenclature and symbols are outdated, which is unlikely to help the student when cross-referencing to contemporary texts and class notes.The final chapter is devoted to the third law and the entropy constant.It is evident from the book that Fermi has a liking for theorems and proofs. The Clapeyron equation, for example, is proved in two different ways for no apparent reason other than to show that it can be done, and his derivation of the phase rule extends over six pages. If you’re a fan of such rigor, there is much for you to enjoy here.Overall, I would say that Fermi’s book has probably passed its time as a course text for the modern student of thermodynamics, but that for the purposes of deepening understanding of the fundamental concepts addressed in the first four chapters, it still has much to recommend it.

fermi presents thermodynamics with beutiful economy. many other authors obfuscate the subject with extraneous detail, often missing the most important points. fermi misses absolutely nothing of importance, but does not weigh down his explanations with ramblings or tangents either. he presents the bare core of thermodynamics.though the following analogy is somewhat cheesy, i find it appropriate: most authors who have written on thermo are like beginning kung fu students who do all sorts of fancy moves, backflips, and sommersaults but who ultimately land on their behinds. fermi is like the grand master who uses a stunning sparsity of moves, but each one is necessary and each one is enough. in the end, his competition doesn’t stand a chance. he’s just that good.

Last week I was having dinner with friends in a restaurant in northern New Mexico. All physicists, slightly drunk, we were debating as different topics as "why did Hannibal not march on Rome after annihilating its legions at the battle of Canne?", or "how could those 19th century guys figure out a concept as like entropy BEFORE knowing statistical mechanics", when many lamented how unnatural thermodynamics felt as undergraduates, and how all textbooks were perhaps not incomplete but incapable of convey the physics. And then I said "well, there is Fermi’s Thermodynamics..." end soon everybody agreed. My freshman course in thermodynamics, in Italy, was based on this book: although it is short and concise, no other text has its compelling clarity in explaining the basic laws. And it has that distinctive Fermi style: cutting the crap, straight to the physical point. Undergraduates learning the subject on any other book are really missing out.

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