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Thermodynamics for Chemists, Physicists and Engineers - Robert Hołyst
2012-07-05

This textbook takes an interdisciplinary approach to the subject of thermodynamics and is therefore suitable for undergraduates in chemistry, physics and engineering courses. The book is an introduction to phenomenological thermodynamics and its applications to phase transitions and chemical reactions, with some references to statistical mechanics. It strikes the balance between the rigorousness of the Callen text and phenomenological approach of the Atkins text. The book is divided in three parts. The first introduces the postulates and laws of thermodynamics and complements these initial explanations with practical examples. The second part is devoted to applications of thermodynamics to phase transitions in pure substances and mixtures. The third part covers thermodynamic systems in which chemical reactions take place. There are some sections on more advanced topics such as thermodynamic potentials, natural variables, non-ideal mixtures and electrochemical reactions, which make this book of suitable also to post-graduate students.

Statistical Mechanics - R K Pathria 2017-02-21

Statistical Mechanics discusses the fundamental concepts involved in understanding the physical properties of matter in bulk on the basis of the dynamical behavior of its microscopic constituents. The book emphasizes the equilibrium states of physical systems. The text first details the statistical basis of thermodynamics, and then proceeds to discussing the elements of ensemble theory. The next two chapters cover the canonical and grand canonical ensemble. Chapter 5 deals with the formulation of quantum statistics, while Chapter 6 talks about the theory of simple gases. Chapters 7 and 8 examine the ideal Bose and Fermi systems. In the next three chapters, the book covers the statistical mechanics of interacting systems, which includes the method of cluster expansions, pseudopotentials, and quantized fields. Chapter 12 discusses the theory of phase transitions, while Chapter 13 discusses fluctuations. The book will be of great use to researchers and practitioners

from wide array of disciplines, such as physics, chemistry, and engineering.

Molecular Engineering Thermodynamics - Juan J. de Pablo 2014-07-10

Building up gradually from first principles, this unique introduction to modern thermodynamics integrates classical, statistical and molecular approaches and is especially designed to support students studying chemical and biochemical engineering. In addition to covering traditional problems in engineering thermodynamics in the context of biology and materials chemistry, students are also introduced to the thermodynamics of DNA, proteins, polymers and surfaces. It includes over 80 detailed worked examples, covering a broad range of scenarios such as fuel cell efficiency, DNA/protein binding, semiconductor manufacturing and polymer foaming, emphasizing the practical real-world applications of thermodynamic principles; more than 300 carefully tailored homework problems, designed to stretch and extend students' understanding of key topics, accompanied by an online solution manual for instructors; and all the necessary mathematical background, plus resources summarizing commonly used symbols, useful equations of state, microscopic balances for open systems, and links to useful online tools and datasets.

Thermodynamics In Nuclear Power Plant Systems - Bahman Zohuri 2015-04-20

This book covers the fundamentals of thermodynamics required to understand electrical power generation systems, honing in on the application of these principles to nuclear reactor power systems. It includes all the necessary information regarding the fundamental laws to gain a complete understanding and apply them specifically to the challenges of operating nuclear plants.

Beginning with definitions of thermodynamic variables such as temperature, pressure and specific volume, the book then explains the laws in detail, focusing on pivotal concepts such as enthalpy and entropy, irreversibility, availability, and Maxwell relations. Specific applications of the fundamentals to Brayton and Rankine cycles for power generation are considered in-depth, in support of the book's core goal- providing an examination of how the thermodynamic principles are applied to the design, operation and safety analysis of current and projected reactor systems. Detailed appendices cover metric and English system units and conversions, detailed steam and gas tables, heat transfer properties, and nuclear reactor system descriptions.

Thermodynamics and Introductory Statistical Mechanics - Bruno Linder 2004-10-20

In this clear and concise introduction to thermodynamics and statistical mechanics the reader, who will have some previous exposure to thermodynamics, will be guided through each of the two disciplines separately initially to provide an in-depth understanding of the area and thereafter the connection between the two is presented and discussed. In addition, mathematical techniques are introduced at appropriate times, highlighting such use as: exact and inexact differentials, partial derivatives, Caratheodory's theorem, Legendre transformation, and combinatorial analysis. * Emphasis is placed equally on fundamentals and applications * Several problems are included

Statistical Physics and Thermodynamics - Jochen Rau 2017

Statistical physics and thermodynamics describe the behaviour of systems on the macroscopic scale. Their methods are applicable to a wide range of phenomena, from neutron stars to heat engines, or from chemical reactions to phase transitions. The pertinent laws are among the most universal ones of all laws

of physics.

Chemical Engineering Education - 1969

A Guide to Thermal Physics - Chris McMullen 2010-08-26

AUDIENCE: This thermodynamics textbook is suitable for all students of thermal physics, from the third semester of introductory calculus-based physics through more advanced coursework in thermodynamics. It provides much greater depth than the coverage of thermal physics in traditional calculus-based physics textbooks, and in this way may be useful to students who are just learning thermal physics. It also provides a solid foundation in the fundamentals and covers both introductory thermal physics (thermal expansion, heat conduction, thermal radiation, ideal gases, and heat engines) and the mathematical formulation of thermodynamics (fundamental relation, Euler and Gibbs-Duhem, thermodynamic potentials, thermodynamic systems, Maxwell relations, and phase transitions) in a more unified way; and in this way may be very helpful to students who are studying undergraduate or graduate level thermodynamics. This textbook also serves as a useful review of thermal physics and thermodynamics for students who have already studied thermodynamics. CONTENT: The beginning chapters are largely geared toward providing a solid foundation of the fundamental concepts and their relationship with the mathematics. The material from these chapters is intended to serve as a valuable introduction for beginning students and self-learners, and also as a useful review for advanced students. The later chapters grow increasingly in-depth: For example, the treatise of heat conduction discusses the integral in a variety of forms and even compares it to more familiar electrical concepts; the chapter on heat engines derives the Carnot efficiency in general using the entropy change integral, and covers a variety of cycles, including the endoreversible engine; and thermodynamics includes not only the usual thermodynamic square, but also the more general octahedron and cross polytope. PREREQUISITES: No previous exposure to thermal physics is assumed. The student should be familiar with the techniques of calculus; a brief review of some relevant techniques, such as partial differentiation, is included. IMPORTANT DISTINCTIONS: Boxes of important distinctions are included in order to help students distinguish between similar concepts - like heat, temperature, and internal energy. TABLE OF EQUATIONS: There is a handy table of equations organized by topic on the back cover of the textbook. This also includes the thermodynamic square. CONCISE OUTLINE FORMAT: The text is conveniently organized by specific topic to help students who may not be reading straight through, but who may be searching for a specific idea or who may be reviewing material that they read previously. There is also a handy index to help locate concepts quickly. Examples and important notes clearly stand out from discussions of concepts. MATHEMATICAL & CONCEPTUAL EMPHASIS: There is much emphasis both on learning the mathematics precisely and understanding the concepts at a deep, precise level. An underlying idea is that students should not guess at concepts, but that concepts are mathematically motivated: Let the equations be your guide. NOTES: Several notes are boxed to describe important points, common mistakes, and exceptions. Hundreds of footnotes are included to discuss subtleties without interrupting the flow of the text. EXAMPLES: Each chapter includes fully-solved

examples to illustrate the main problem-solving strategies. PRACTICE: The end of each chapter has a good selection of instructive conceptual questions and practice problems. HINTS & ANSWERS: 100% of the conceptual questions have both hints and answers, since it's crucial to develop a solid understanding of the concepts in order to succeed in physics. Some of the practice problems have answers to help independent students gain confidence by reproducing the same answers, while 100% of the practice problems have hints so that students can see if they are solving the problems correctly.

An Introduction to Statistical Mechanics and Thermodynamics - Robert H. Swendsen 2012-03

This text presents statistical mechanics and thermodynamics as a theoretically integrated field of study. It stresses deep coverage of fundamentals, providing a natural foundation for advanced topics. The large problem sets (with solutions for teachers) include many computational problems to advance student understanding.

Thermodynamics and Chemistry \ - Howard DeVoe 2019

Thermodynamics and Its Applications - Michael Modell 1983

Nonequilibrium Thermodynamics and Fluctuation Kinetics - Léon Brenig 2022-11-12

This book addresses research challenges in the rapidly developing area of nonequilibrium thermodynamics and fluctuation kinetics. This cross-disciplinary field comprises various topics, ranging from fundamental problems of nonequilibrium statistical mechanics and thermodynamics to multiple applications in plasma, fluid mechanics, nonlinear science, systems of dissipative particles, and high-Q resonators. The purpose of this book is to bring together world-leading experts in the above fields to initiate a cross-fertilization among these active research areas. The book is dedicated to and honours the memory of Professor Slava Belyi who passed away unexpectedly on May 20, 2020. He was pioneering the theory of nonequilibrium fluctuations, in particular the application of the Callen-Welton fluctuation-dissipation theorem to nonequilibrium systems and its generalization. This and related problems also feature in the book.

A Review of Undergraduate Physics - Benjamin F. Bayman 1986-03-12

A study aid for senior and graduate level students needing a review of undergraduate physics. Covers a broad range of topics, with carefully worked examples illustrating important problem-solving methods. A collection of self-test problems helps students prepare for the College Entrance Advanced Physics Examination and the Qualifying Written Examination for the PhD.

Solutions Manual for Thermodynamics and an Introduction to Thermostatistics, Second Edition - Herbert B. Callen 1986

The Publishers' Trade List Annual - 1967

Cardiovascular Soft Tissue Mechanics - Stephen C. Cowin 2007-05-08

This special volume of the Journal of Elasticity represents the first in a new p-gram dedicated to the occasional publication of collections of invited, reviewed papers of topical interest. The purpose of this program is to

spotlight the developments and applications in the mechanics of materials within specific areas that can enhance growth and provide insight for the advancement of the field as well as promote fundamental understanding and basic discovery. Soft Tissue Mechanics is an area of biomechanics that draws heavily upon fundamental ideas and material models from nonlinear elasticity and viscoelasticity. A major goal of this research is to understand those mechanics properties of heart, artery, collagen and skeletal muscle tissue that can be used for the diagnosis of health problems and the improvement of human life. This volume illustrates how experiment, modeling and computation is currently employed in this emerging field. May 2001 ROGER FOSDICK Editor-in-Chief Journal of Elasticity 61: ix–xii, 2000. ix Preface There are two primary areas for the application of elasticity in the biomechanics of tissues: hard tissue mechanics (e.g., bone, teeth, horns, etc.) and soft tissue mechanics (e.g., skin, tendons, arteries, etc.). The distinguishing feature between these tissue types is the amount of physiological “normal” deformation they experience. While “hard” tissues only experience small deformations, soft tissues typically experience large deformations. From a biomechanics viewpoint soft tissues fall within the realm of finite elasticity.

An Introduction to Statistical Thermodynamics - Terrell L. Hill 2012-06-08

Four-part treatment covers principles of quantum statistical mechanics, systems composed of independent molecules or other independent subsystems, and systems of interacting molecules, concluding with a consideration of quantum statistics.

Solved Problems in Thermodynamics and Statistical Physics - Gregor Skačej
2019-11-09

This book contains a modern selection of about 200 solved problems and examples arranged in a didactic way for hands-on experience with course work in a standard advanced undergraduate/first-year graduate class in thermodynamics and statistical physics. The principles of thermodynamics and equilibrium statistical physics are few and simple, but their application often proves more involved than it may seem at first sight. This book is a comprehensive complement to any textbook in the field, emphasizing the analogies between the different systems, and paves the way for an in-depth study of solid state physics, soft matter physics, and field theory.

Thermodynamics and Statistical Mechanics - Walter Greiner 2012-12-06

From the reviews: "This book excels by its variety of modern examples in solid state physics, magnetism, elementary particle physics [...] I can recommend it strongly as a valuable source, especially to those who are teaching basic statistical physics at our universities." Physicalia

An Introduction to Thermodynamics and Statistical Mechanics - Keith Stowe
2007-05-10

This introductory textbook for standard undergraduate courses in thermodynamics has been completely rewritten to explore a greater number of topics, more clearly and concisely. Starting with an overview of important quantum behaviours, the book teaches students how to calculate probabilities in order to provide a firm foundation for later chapters. It introduces the ideas of classical thermodynamics and explores them both in general and as they are applied to specific processes and interactions. The remainder of the book deals

with statistical mechanics. Each topic ends with a boxed summary of ideas and results, and every chapter contains numerous homework problems, covering a broad range of difficulties. Answers are given to odd-numbered problems, and solutions to even-numbered problems are available to instructors at www.cambridge.org/9781107694927.

Statistical Thermodynamics - Normand M. Laurendeau 2005-11-21

This 2006 textbook discusses the fundamentals and applications of statistical thermodynamics for beginning graduate students in the physical and engineering sciences. Building on the prototypical Maxwell–Boltzmann method and maintaining a step-by-step development of the subject, this book assumes the reader has no previous exposure to statistics, quantum mechanics or spectroscopy. The book begins with the essentials of statistical thermodynamics, pauses to recover needed knowledge from quantum mechanics and spectroscopy, and then moves on to applications involving ideal gases, the solid state and radiation. A full introduction to kinetic theory is provided, including its applications to transport phenomena and chemical kinetics. A highlight of the textbook is its discussion of modern applications, such as laser-based diagnostics. The book concludes with a thorough presentation of the ensemble method, featuring its use for real gases. Numerous examples and prompted homework problems enrich the text.

Statistical Mechanics of Lattice Systems - Sacha Friedli 2017-11-23

A self-contained, mathematical introduction to the driving ideas in equilibrium statistical mechanics, studying important models in detail.

Thermodynamics For Dummies - Mike Pauken 2011-07-12

Take some heat off the complexity of thermodynamics Does the mere thought of thermodynamics make you sweat? It doesn't have to! This hands-on guide helps you score your highest in a thermodynamics course by offering easily understood, plain-English explanations of how energy is used in things like automobiles, airplanes, air conditioners, and electric powerplants. Thermodynamics 101 – take a look at some examples of both natural and man-made thermodynamic systems and get a handle on how energy can be used to perform work Turn up the heat – discover how to use the first and second laws of thermodynamics to determine (and improve upon) the efficiency of machines Oh, behave – get the 411 on how gases behave and relate to one another in different situations, from ideal-gas laws to real gases Burn with desire – find out everything you need to know about conserving mass and energy in combustion processes Open the book and find: The laws of thermodynamics Important properties and their relationships The lowdown on solids, liquids, and gases How work and heat go hand in hand The cycles that power thermodynamic processes Chemical mixtures and reactions Ten pioneers in thermodynamics Real-world applications of thermodynamic laws and concepts Learn to: Master the concepts and principles of thermodynamics Develop the problem-solving skills used by professional engineers Ace your thermodynamics course

American Journal of Physics - 1987

Introductory Chemical Engineering Thermodynamics - J. Richard Elliott
2012-02-06

A Practical, Up-to-Date Introduction to Applied Thermodynamics, Including

Coverage of Process Simulation Models and an Introduction to Biological Systems Introductory Chemical Engineering Thermodynamics, Second Edition, helps readers master the fundamentals of applied thermodynamics as practiced today: with extensive development of molecular perspectives that enables adaptation to fields including biological systems, environmental applications, and nanotechnology. This text is distinctive in making molecular perspectives accessible at the introductory level and connecting properties with practical implications. Features of the second edition include Hierarchical instruction with increasing levels of detail: Content requiring deeper levels of theory is clearly delineated in separate sections and chapters Early introduction to the overall perspective of composite systems like distillation columns, reactive processes, and biological systems Learning objectives, problem-solving strategies for energy balances and phase equilibria, chapter summaries, and "important equations" for every chapter Extensive practical examples, especially coverage of non-ideal mixtures, which include water contamination via hydrocarbons, polymer blending/recycling, oxygenated fuels, hydrogen bonding, osmotic pressure, electrolyte solutions, zwitterions and biological molecules, and other contemporary issues Supporting software in formats for both MATLAB® and spreadsheets Online supplemental sections and resources including instructor slides, ConcepTests, coursecast videos, and other useful resources

Scientific and Technical Books in Print - 1972

Equilibrium Statistical Physics - Michael Plischke 1994

This textbook concentrates on modern topics in statistical physics with an emphasis on strongly interacting condensed matter systems. The book is self-contained and is suitable for beginning graduate students in physics and materials science or undergraduates who have taken an introductory course in statistical mechanics. Phase transitions and critical phenomena are discussed in detail including mean field and Landau theories and the renormalization group approach. The theories are applied to a number of interesting systems such as magnets, liquid crystals, polymers, membranes, interacting Bose and Fermi fluids; disordered systems, percolation and spin of equilibrium concepts are also discussed. Computer simulations of condensed matter systems by Monte Carlo-based and molecular dynamics methods are treated.

Engineering and Chemical Thermodynamics - Milo D. Koretsky 2012-12-17

Chemical engineers face the challenge of learning the difficult concept and application of entropy and the 2nd Law of Thermodynamics. By following a visual approach and offering qualitative discussions of the role of molecular interactions, Koretsky helps them understand and visualize thermodynamics. Highlighted examples show how the material is applied in the real world. Expanded coverage includes biological content and examples, the Equation of State approach for both liquid and vapor phases in VLE, and the practical side of the 2nd Law. Engineers will then be able to use this resource as the basis for more advanced concepts.

Thermodynamics - Enrico Fermi 2012-04-25

In this classic of modern science, the Nobel laureate presents a clear treatment of systems, the First and Second Laws of Thermodynamics, entropy,

thermodynamic potentials, and much more. Calculus required.

Statistical and Thermal Physics - Harvey Gould 2021-09-14

This revised and expanded edition of *Statistical and Thermal Physics* introduces students to the essential ideas and techniques used in many areas of contemporary physics. Ready-to-run programs help make the many abstract concepts concrete. The text requires only a background in introductory mechanics and some basic ideas of quantum theory, discussing material typically found in undergraduate texts as well as topics such as fluids, critical phenomena, and computational techniques, which serve as a natural bridge to graduate study. --

Problems and Solutions on Thermodynamics and Statistical Mechanics - Yung-kuo Lim 1990

Volume 5.

Statistical Physics of Particles - Mehran Kardar 2007-06-07

Statistical physics has its origins in attempts to describe the thermal properties of matter in terms of its constituent particles, and has played a fundamental role in the development of quantum mechanics. Based on lectures taught by Professor Kardar at MIT, this textbook introduces the central concepts and tools of statistical physics. It contains a chapter on probability and related issues such as the central limit theorem and information theory, and covers interacting particles, with an extensive description of the van der Waals equation and its derivation by mean field approximation. It also contains an integrated set of problems, with solutions to selected problems at the end of the book and a complete set of solutions is available to lecturers on a password protected website at www.cambridge.org/9780521873420. A companion volume, *Statistical Physics of Fields*, discusses non-mean field aspects of scaling and critical phenomena, through the perspective of renormalization group.

Numerical Methods for Chemical Engineering - Kenneth J Beers 2007

Applications of numerical mathematics and scientific computing to chemical engineering.

Entropy and Free Energy in Structural Biology - Hagai Meirovitch 2020-08-14

Computer simulation has become the main engine of development in statistical mechanics. In structural biology, computer simulation constitutes the main theoretical tool for structure determination of proteins and for calculation of the free energy of binding, which are important in drug design. *Entropy and Free Energy in Structural Biology* leads the reader to the simulation technology in a systematic way. The book, which is structured as a course, consists of four parts: Part I is a short course on probability theory emphasizing (1) the distinction between the notions of experimental probability, probability space, and the experimental probability on a computer, and (2) elaborating on the mathematical structure of product spaces. These concepts are essential for solving probability problems and devising simulation methods, in particular for calculating the entropy. Part II starts with a short review of classical thermodynamics from which a non-traditional derivation of statistical mechanics is devised. Theoretical aspects of statistical mechanics are reviewed extensively. Part III covers several topics in non-equilibrium thermodynamics and statistical mechanics close to equilibrium, such as Onsager relations, the

two Fick's laws, and the Langevin and master equations. The Monte Carlo and molecular dynamics procedures are discussed as well. Part IV presents advanced simulation methods for polymers and protein systems, including techniques for conformational search and for calculating the potential of mean force and the chemical potential. Thermodynamic integration, methods for calculating the absolute entropy, and methodologies for calculating the absolute free energy of binding are evaluated. Enhanced by a number of solved problems and examples, this volume will be a valuable resource to advanced undergraduate and graduate students in chemistry, chemical engineering, biochemistry biophysics, pharmacology, and computational biology.

Understanding Thermodynamics - H.C. Van Ness 2012-06-08

Clear treatment of systems and first and second laws of thermodynamics features informal language, vivid and lively examples, and fresh perspectives. Excellent supplement for undergraduate science or engineering class.

Heat Conduction - David W. Hahn 2012-08-20

The long-awaited revision of the bestseller on heat conduction Heat Conduction, Third Edition is an update of the classic text on heat conduction, replacing some of the coverage of numerical methods with content on micro- and nanoscale heat transfer. With an emphasis on the mathematics and underlying physics, this new edition has considerable depth and analytical rigor, providing a systematic framework for each solution scheme with attention to boundary conditions and energy conservation. Chapter coverage includes: Heat conduction fundamentals Orthogonal functions, boundary value problems, and the Fourier Series The separation of variables in the rectangular coordinate system The separation of variables in the cylindrical coordinate system The separation of variables in the spherical coordinate system Solution of the heat equation for semi-infinite and infinite domains The use of Duhamel's theorem The use of Green's function for solution of heat conduction The use of the Laplace transform One-dimensional composite medium Moving heat source problems Phase-change problems Approximate analytic methods Integral-transform technique Heat conduction in anisotropic solids Introduction to microscale heat conduction In addition, new capstone examples are included in this edition and extensive problems, cases, and examples have been thoroughly updated. A solutions manual is also available. Heat Conduction is appropriate reading for students in mainstream courses of conduction heat transfer, students in mechanical engineering, and engineers in research and design functions throughout industry.

Thermodynamics and an Introduction to Thermostatistics - Herbert B. Callen 1991-01-16

The only text to cover both thermodynamic and statistical mechanics--allowing students to fully master thermodynamics at the macroscopic level. Presents essential ideas on critical phenomena developed over the last decade in simple, qualitative terms. This new edition maintains the simple structure of the first and puts new emphasis on pedagogical considerations. Thermostatistics is incorporated into the text without eclipsing macroscopic thermodynamics, and is integrated into the conceptual framework of physical theory.

Introduction to Modern Statistical Mechanics - David Chandler 1987

Lectures on elementary statistical mechanics, taught at the University of Illinois and at the University of Pennsylvania.

An Expedition to Continuum Theory - Wolfgang H. Müller 2014-01-18

This book introduces field theory as required in solid and fluid mechanics as well as in electromagnetism. It includes the necessary applied mathematical framework of tensor algebra and tensor calculus, using an inductive approach particularly suited to beginners. It is geared toward undergraduate classes in continuum theory for engineers in general, and more specifically to courses in continuum mechanics. Students will gain a sound basic understanding of the subject as well as the ability to solve engineering problems by applying the general laws of nature in terms of the balances for mass, momentum, and energy in combination with material-specific relations in terms of constitutive equations, thus learning how to use the theory in practice for themselves. This is facilitated by numerous examples and problems provided throughout the text.

Thermodynamics and Statistical Mechanics - Robert J. Hardy 2014-06-23

Thermodynamics and Statistical Mechanics
Thermodynamics and Statistical Mechanics An Integrated Approach
This textbook brings together the fundamentals of the macroscopic and microscopic aspects of thermal physics by presenting thermodynamics and statistical mechanics as complementary theories based on small numbers of postulates. The book is designed to give the instructor flexibility in structuring courses for advanced undergraduates and/or beginning graduate students and is written on the principle that a good text should also be a good reference. The presentation of thermodynamics follows the logic of Clausius and Kelvin while relating the concepts involved to familiar phenomena and the modern student's knowledge of the atomic nature of matter. Another unique aspect of the book is the treatment of the mathematics involved. The essential mathematical concepts are briefly reviewed before using them, and the similarity of the mathematics to that employed in other fields of physics is emphasized. The text gives in-depth treatments of low-density gases, harmonic solids, magnetic and dielectric materials, phase transitions, and the concept of entropy. The microcanonical, canonical, and grand canonical ensembles of statistical mechanics are derived and used as the starting point for the analysis of fluctuations, blackbody radiation, the Maxwell distribution, Fermi-Dirac statistics, Bose-Einstein condensation, and the statistical basis of computer simulations.