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This book goes beyond the scope of other works in the field with its thorough treatment of applications in a wide variety of disciplines. The third edition features a new section on constants of motion and symmetry and a new appendix on the Lorentz-Legendre expansion. An essential cross-disciplinary reference for molecular interactions Molecular Theory of Gases and Liquids offers a rigorous, comprehensive treatment of molecular characteristics and behaviors in the gaseous and fluid states. A unique cross-disciplinary approach provides useful insight for students of chemistry, chemical engineering, fluid dynamics, and a variety of related fields, with thorough derivations and in-depth explanations throughout. Appropriate for graduate students and working scientists alike, this book details advanced concepts without sacrificing depth of coverage or technical detail. Many laboratory and astrophysical plasmas show deviations from local ther modynamic equilibrium (LTE). This monograph develops non-LTE plasma spectroscopy as a kinetic theory of particles and photons, considering the radiation field as a photon gas whose distribution function (the radiation in tensity) obeys a kinetic equation (the radiative transfer equation), just as the distribution functions of particles obey kinetic equations. Such a unified ap proach provides clear insight into the physics of non-LTE plasmas. Chapter 1 treats the principle of detailed balance, of central importance for understanding the non-LTE effects in plasmas. Chapters 2, 3 deal with kinetic equations of particles and photons, respectively, followed by a chapter on the fluid description of gases with radiative interactions. Chapter 5 is devoted to the H theorem, and closes the more general first part of the book. The last two chapters deal with more specific topics. After briefly discuss ing optically thin plasmas, Chap. 6 treats non-LTE line transfer by two-level atoms, the line profile coefficients of three-level atoms, and non-Maxwellian electron distribution functions. Chapter 7 discusses topics where momentum exchange between matter and radiation is crucial: the approach to thermal equilibrium through interaction with blackbody radiation, radiative forces, and Compton scattering. A number of appendices have been added to make the book self-contained and to treat more special questions. In particular, Appendix B contains an in troductory discussion of atomic line profile coefficients. This introduction to the molecular theory of gases and modern transport theory includes such basic concepts as distribution function, classical theory of specific heats, binary collisions, mean free path and reaction rates, as well as topics relevant to advanced transport theory. Excerpt from A Kinetic Theory of Gases and Liquids In constructing a general Kinetic Theory the problem that presents itself first for investigation is the dependence of the velocity of translation of a molecule in a substance on its density and temperature. It is often assumed that this velocity is the same in the liquid as in the gaseous state at the same temperature. It can be shown, however, that this holds only for each molecule at the instant it passes through a point in the substance at which the forces of the surrounding molecules neutralize each other. The total average velocity corresponding to the whole path of a mole cule is usually much greater than the foregoing velocity in a liquid and dense gas on account of the effect of the molecular forces of attraction and repulsion. About the Publisher Forgotten Books publishes hundreds of thousands of rare and classic books. Find more at www.forgottenbooks.com This book is a reproduction of an important historical work. Forgotten Books uses state-of-the-art technology to digitally reconstruct the work, preserving the original format whilst repairing imperfections present in the aged copy. In rare cases, an imperfection in the original, such as a blemish or missing page, may be replicated in our edition. We do, however, repair the vast majority of imperfections successfully; any imperfections that remain are intentionally left to preserve the state of such historical works. Excerpt from A Treatise on the Kinetic Theory of Gases We are obliged therefore to abandon' the strictly kinetic method and to adopt the statistical method. About the Publisher Forgotten Books publishes hundreds of thousands of rare and classic books. Find more at www.forgottenbooks.com This book is a reproduction of an important historical work. Forgotten Books uses state-of-the-art technology to digitally reconstruct the work, preserving the original format whilst repairing imperfections present in the aged copy. In rare cases, an imperfection in the original, such as a blemish or missing page, may be replicated in our edition. We do, however, repair the vast majority of imperfections successfully; any imperfections that remain are intentionally left to preserve the state of such historical works. A pioneering text in its field, this comprehensive study is one of the most valuable texts and references available. The author explores the classical kinetic theory in the first four chapters, with discussions of the mechanical picture of a perfect gas, the mean free path, and the distribution of molecular velocities. Tbhe fifth chapter deals with the more accurate equations of state, or Van der Waals' equation, and later chapters examine viscosity, heat conduction, surface phenomena, and Browninan movements. The text surveys the application of quantum theory to the problem of specific heats and the contributions of kinetic theory to knowledge of electrical and magnetic properties of molecules, concluding with applications of the kinetic theory to the conduction of electricity in gases. 1934 edition. This monograph and text was designed for first-year students of physical chemistry who require further details of kinetic theory. The treatment focuses chiefly on the molecular basis of important thermodynamic properties of gases, including pressure, temperature, and thermal energy. Includes numerous exercises, many partially worked out, and end-of-chapter problems. 1966 edition. This work has been selected by scholars as being culturally important, and is part of the knowledge base of civilization as we know it. This work was reproduced from the original artifact, and remains as true to the original work as possible. Therefore, you will see the original copyright references, library stamps (as most of these works have been housed in our most important libraries around the world), and other notations in the work. This work is in the public domain in the United States of America, and possibly other nations. Within the United States, you may freely copy and distribute this work, as no entity (individual or corporate) has a copyright on the body of the work. As a reproduction of a historical artifact, this work may contain missing or blurred pages, poor pictures, errant marks, etc. Scholars believe, and we concur, that this work is important enough to be preserved, reproduced, and made generally available to the public. We appreciate your support of the preservation process, and thank you for being an important part of keeping this knowledge alive and relevant. This book can be described as a student's edition of the author's Dynamical Theory of Gases. It is written, however, with the needs of the student of physics and physical chemistry in mind, and those parts of which the interest was mainly mathematical have been discarded. This does not mean that the book contains no serious mathematical discussion; the discussion in particular of the distribution law is quite detailed; but in the main the mathematics is concerned with the discussion of particular phenomena rather than with the discussion of fundamentals. A thorough examination of kinetic theory and its successes in understanding and describing irreversible phenomena in physical systems. Kinetic Theory of Nonideal Gases and Nonideal Plasmas presents the fundamental aspects of the kinetic theory of gases and plasmas. The book consists of three parts, which attempts to present some of the ideas, methods and applications in the study of the kinetic processes in nonideal gases and plasmas. The first part focuses on the classical kinetic theory of nonideal gases. The second part discusses the classical kinetic theory of fully ionized plasmas. The last part is devoted to the quantum kinetic theory of nonideal gases and plasmas. A concluding chapter is included, which presents a short account of the kinetic theory of chemically reacting systems and of partially ionized plasmas, in order to espouse further studies in the field. Physicists, scientific researchers, professors, and graduate students in various fields will find the text of good use. This classic book, now reissued in paperback, presents a detailed account of the mathematical theory of viscosity, thermal conduction, and diffusion in non-uniform gases based on the solution of the Maxwell-Boltzmann equations. The theory of Chapman and Enskog, describing work on dense gases, quantum theory of collisions, and the theory of conduction and diffusion in ionized gases in the presence of electric and magnetic fields is also included in the later chapters. This reprint of the third edition, first published in 1970, includes revisions that take account of extensions of the theory to fresh molecular models and of new methods used in discussing dense gases and plasmas. Fundamentals of Maxwel's Kinetic Theory of a Simple Monatomic Gas Appendices after each chapter This book introduces physics students and teachers to the historical development of the kinetic theory of gases, by providing a collection of the most important contributions by Clausius, Maxwell and Boltzmann, with introductory surveys explaining their significance. In addition, extracts from the works of Boyle, Newton, Mayer, Joule, Helmholtz, Kelvin and others show the historical context of ideas about gases, energy and irreversibility. In addition to five thematic essays connecting the classical kinetic theory with 20th century topics such as indeterminism and interatomic forces, there is an extensive international bibliography of historical commentaries on kinetic theory, thermodynamics, etc. published in the past four decades.The book will be useful to historians of science who need primary and secondary sources to be conveniently available for their own research and interpretation, along with the bibliography which makes it easier to learn what other historians have already done on this subject. Kinetic Theory, Volume 2: Irreversible Processes compiles the fundamental papers on the kinetic theory of gases. This book comprises the two papers by Maxwell and Boltzmann in which the basic equations for transport processes in gases are formulated, as well as the first derivation of Boltzmann's “H-theorem and problem of irreversibility. Other topics include the dynamical theory of gases; kinetic theory of the dissipation of energy; three-body problem and the equations of dynamics; theorem of dynamics and the mechanical theory of heat; and mechanical explanation of irreversible processes. This volume is beneficial to physics students in the advanced undergraduate or postgraduate level. For two gas species with a temperature difference and a bulk velocity difference neither of which is necessarily small in magnitude, the kinetic theory of gases has been used to derive explicit expressions for the collision frequency, diffusive drag force, molecular translational energy transfer rate, and the bimolecular chemical reaction frequency. The derivations, which are based upon hypothesized mutual collision diameters, activation energies, and steric factors, are of interest in connection with theoretical studies of low-pressure gas mixtures with large departures from equilibrium. A binary temperature concept is introduced as an aid in condensing and interpreting the expressions derived from the kinetic theory The expression derived for the diffusive drag force is used to give a more definite form to the equations of motion of the individual species in a mixture of several interdiffusing gases. Kinetic Theory, Volume I: The Nature of Gases and of Heat deals with kinetic theory and the nature of gases and heat. A comprehensive account of the life, works, and historical environment of a number of scientists such as Robert Boyle and Hermann von Helmholtz is presented. This volume is comprised of 11 chapters and begins with an overview of the caloric theory, the principle of conservation of energy, the ""virial theorem,"" and atomic magnitudes. The discussion then turns to the qualitative atomic theory of the ""spring"" of the air, proposed by Robert Boyle; Isaac Newton's repulsion theory; Daniel Bernoulli's thery on the properties and motions of elastic fluids, especially air; and George Gregory's theory on the existence of fire. Subsequent chapters focus on Robert Mayer's theory on the forces of inorganic nature; James Joule's theory on matter, living force, and heat; Hermann von Helmholtz's theory on the conservation of force; and Rudolf Clausius's theory on the nature of heat. James Clerk Maxwell's dynamical theory of gases is also examined. This book is written primarily for students and research workers in physics, as well as for historians of science. In contrast to molecular gases (for example, air), the particles of granular gases, such as a cloud of dust, lose part of their kinetic energy when they collide, giving rise to many exciting physical properties. The book provides a self-contained introduction to the theory of granular gases for advanced undergraduates and beginning graduates. The world is governed by motions. The term kinetics partially originated from the Greek word "kinisis," which means motion. How important is motion in our life is easily understood. But, how the kinetic theories have been developed during years? Which are the new kinetic theories and updates in recent years? This question and many others can be answered with this book. Some important areas discussed in this book are the kinetic theory of gases, kinetic theory of liquids and vapors, thermodynamic aspects, transportation phenomena, adsorption-kinetic theories, linear and nonlinear kinetic equations, quantum kinetic theory, kinetic theory of nucleation, plasma kinetic theory, and relativistic kinetic theory.