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BOOK REVIEW

Santosh K. Upadhyay. Chemical Kinetics and Reaction Dynamics.

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True to its title, this book aims to deliver a clear and comprehensive, textbook-like presentation of a topic that is central to physical chemistry: the chemical changes occurring in reacting systems. Although there is no shortage of well-written alternative material in this field, this work distinguishes itself by gathering under a single cover both basic, introductory concepts presented in a manner that facilitates a sound understanding of the principles of chemical kinetics, and more advanced topics such as special catalytic, oscillatory, solid-state and polymerization reactions.

In order to achieve its goals, the book focuses on two major aspects: (i) discussing the different mechanisms and kinetic processes that govern chemical reactions, and (ii) explaining the relations between reaction rates and the underlying microscopic molecular dynamics of the reacting systems. The former aspect is present throughout the book, being the main topic of the introductory chapters (1 to 3), while the latter aspect is emphasized in the discussions of theories for reaction rates (Chap. 4), of special reactions (Chaps. 5 to 8), and of molecular reaction dynamics (Chap. 9).

The book begins with a clear presentation of the elementary theoretical concepts required for understanding chemical kinetics, and of the related experimental approaches to measuring reaction rates (Chap. 1). Chapters 2 and 3 present the temperature dependence of rates and the kinetics of complex reactions, respectively. Chapter 4 offers an introduction to the main statistical mechanical concepts, from collision theory to transition-state theory, which are used to explain the dependency of transition rates on specific microscopic parameters of the reacting systems. Chapter 5 presents kinetics of special reactions, from photochemical to oscillatory (e.g., Belousov–Zhabotinskii), polymerization, solid-state and electron transfer reactions. In Chap. 6, the special case of catalytic reactions is discussed in detail, with interesting notes on micellar and phase transfer catalysis, and on inhibition processes. Experimental techniques for studying fast reactions are discussed in Chap. 7, while Chap. 8

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deals with a detailed discussion of the concepts and effects specific to reactions in solution. These aspects would be especially appealing to readers interested in modern experimental studies of biomolecules.

Notably, the first eight chapters contain useful problems with detailed solutions that thoroughly guide the reader, as well as proposed exercises listed at the end of each chapter. The prerequisite background of the readership is a basic knowledge of general and physical chemistry, and sufficient mathematical ability to evaluate simple integrals and to solve linear differential equations.

The final Chap. 9 is focused on a discussion of reaction dynamics and of the relationship between microscopic processes, interaction potentials, and the macroscopic kinetic behavior of chemical reactions.

To conclude, the theory of chemical kinetics is one of the most mature and important topics in physical chemistry. This book offers a useful and informative knowledge base in this field, addressing the needs of a broad, multidisciplinary readership, from undergraduate students of physical chemistry to researchers from both academics and industrial environments that need a modern, comprehensive, textbook-style information resource on chemical kinetic processes.