

PHYSICAL

PHARMACY

ALFRED MARTIN

FOURTH EDITION

Physical Pharmacy

PHYSICAL CHEMICAL PRINCIPLES IN THE PHARMACEUTICAL SCIENCES

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Dedicated to my parents
Rachel and Alfred Martin, Sr.,
my wife, Mary, and my sons,
Neil and Douglas.

Preface

The fourth edition of *Physical Pharmacy* is concerned, as were earlier editions, with the use of physical chemical principles as applied to the various branches of pharmacy. Its purpose is to help students, teachers, researchers, and manufacturing pharmacists use the elements of mathematics, chemistry, and physics in their work and study. The new edition has been updated and revised to reflect a decade of current advances, concepts, methods, instrumentation and new dosage forms and delivery systems.

Two chapters in the third edition—Introductory Calculus and Atomic and Molecular Structure—have been removed. The calculus chapter has been replaced by an appendix that provides necessary rules of differentiation and integration. The space made available by these deletions has allowed extensive revision in other chapters: Complexation and Protein Binding, Kinetics, Interfacial Phenomena, Colloids, Rheology, and Coarse Dispersions. The chapter on Drug Product Design has been rewritten and expanded to reflect the many advances in controlled drug delivery systems over the past two decades. The problems at the end of the chapters have been varied and considerably increased in number.* This new and revised edition will bring readers up-to-date with the last 10 years of progress in the physical and chemical foundations of the pharmaceutical sciences.

The author acknowledges the outstanding contributions of Professor Pilar Bustamante to the preparation of this fourth edition with regard to originating new problems and writing a major part of Chapter 19, Drug Product Design. The time and professional devotion she gave to the revision process, in a variety of ways, was exceptional. Dr. A. H. C. Chun prepared most of the

illustrations, as he has skillfully done for each of the editions. Dr. Stephen Baron, who checked the problems in the first edition, has again assisted in reviewing the problems and in reading galley proof for the fourth edition.

The author expresses his appreciation for additional contributions to this book by Dr. R. Bodmeier, University of Texas; Dr. Peter R. Byron, Virginia Commonwealth University; Dr. S. Cohen, Tel-Aviv University, Israel; Dr. T. D. J. D'Silva, Rhone-Poulenc; Dr. J. B. Dressman, University of Michigan; Dr. J. Keith Guillery, University of Iowa; Dr. V. D. Gupta, University of Houston; Dr. Bhupendra Hajratwala, Wayne State University; Dr. E. Hamlow, Bristol-Meyers Squibb; Dr. A. J. Hickey, University of Illinois at Chicago; S. Jarmell, Fisher Scientific; Dr. A. E. Klein, Oneida Research Services; Dr. A. P. Kurtz, Rhone-Poulenc; Dr. Z. Liron, Tel-Aviv University, Israel; Dr. T. Ludden, U.S. Federal Food and Drug Administration; Dr. James McGinity, University of Texas; B. Millan-Hernandez, Sterling International, Caracas, Venezuela; Dr. Paul J. Niebergall, Medical University of South Carolina; Dr. Robert Pearlman, University of Texas; Dr. R. J. Pranker, University of Florida; H. L. Rao, Manipal, India; Dr. E. G. Rippie, University of Minnesota; T. Rossi, Fisher Scientific; Dr. Hans Schott, Temple University; Dr. V. J. Stella, University of Kansas; Dr. Felix Theeuwes, Alza Corporation; Dr. K. Tojo, Kyushu Institute of Technology, Japan; and Dr. J. Zheng, Shanghai Medical University.

Recognition is also given for the use of data and reference material found in the Merck Index, 11th Edition, Merck, 1989; the U.S. Pharmacopeia, XXII-NF XVII, U.S. Pharmacopeial Convention, 1990;

*The percent increase in figures, tables, and so on in the 4th edition of *Physical Pharmacy* as compared with those in the 3rd edition is as follows:

	Figures	Tables	References	Equations	Examples	Problems
% Increase	12	2	45	17	32	107

and the CRC Handbook of Chemistry and Physics, 63rd Edition, CRC Press, 1982. The author acknowledges with thanks the use of problems patterned after some of those in J. William Moncrief and William H. Jones, *Elements of Physical Chemistry*, Addison-Wesley, 1977; Raymond Chang, *Physical Chemistry with Applications to Biological Systems*, 2nd Edition, Macmillan, 1981; and David Eisenberg and Donald Crothers, *Physical Chemistry with Application to the Life Sciences*, Benjamin/Cummings, 1979.

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ALFRED MARTIN

Contents

1. Introduction	1
2. States of Matter	22
3. Thermodynamics	53
4. Physical Properties of Drug Molecules	77
5. Solutions of Nonelectrolytes	101
6. Solutions of Electrolytes	125
7. Ionic Equilibria	143
8. Buffered and Isotonic Solutions	169
9. Electromotive Force and Oxidation—Reduction	190
10. Solubility and Distribution Phenomena	212
11. Complexation and Protein Binding	251
12. Kinetics	284
13. Diffusion and Dissolution	324
14. Interfacial Phenomena	362
15. Colloids	393
16. Micromeritics	423
17. Rheology	453
18. Coarse Dispersions	477
19. Drug Product Design	512
20. Polymer Science	556
Appendix: Calculus Review	595
Index	603