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BOOK REVIEW

Ionic equilibrium, solubility and pH calculations. J.N. Butler, with a chapter by D.R. Cogley (1998), Wiley, New York. Printed pages 559; price: US$ 84.95. ISBN 0-471-58526-2

Ionic equilibria play a basic role in chemistry, especially in electrochemistry. Without a profound knowledge of how to perform equilibrium calculations it is simply impossible to work in chemistry. Anybody who handles electrolyte solutions, e.g. a biochemist, a physicist, a medical doctor in research, needs some expertise and teaching in this field, which is traditionally taught in chemistry courses as the theoretical foundations of analytical chemistry. It is a very traditional area, with not too many new contributions within the last two decades, which, however, has substantially benefited from the enormous development of computational facilities. From the experimental side, contributions mainly concern the determination of new equilibrium constants and a deeper insight into the complex equilibrium schemes of naturally occurring systems. Bearing in mind the importance of the subject, a new book will be certainly welcome. Just to welcome it, however, would mean to greatly underestimate this book. This book must be greeted with enthusiasm! This is a highlight of chemical literature, a book of outstanding quality, which will be used for a very long time.

The author, J.N. Butler, a Gordon McKay Professor of Applied Chemistry at Harvard University, is very well known for the book "Solubility and pH calculations" (1964), and for many original contributions. "Ionic equilibrium, solubility and pH calculations" contains much more than the title suggests. The author starts with basic principles (chapter 1), as a general description of a chemical equilibrium, concentration scales, dissociation constants, etc., just to set the basis for a deeper treatment in the following chapters. In chapters 2–11 he addresses the following subjects: activity coefficients and pH calculations (chapter 2), strong acids and bases (chapter 3), monoprotic acids and bases (chapter 4), polyprotic acids and bases (chapter 5), solubility (chapter 6), complex formation (chapter 7), organic complexes (chapter 8), oxidation–reduction equilibria (chapter 9), carbon dioxide (chapter 10), and pH in brines (chapter 11). I was happy to see that the author wrote a special paragraph in chapter 9 entitled "Can there be a unique redox potential in an aqueous solution?" I know that a sound knowledge of this question is not widespread among chemists, not to speak of biologists, biochemists, etc. This is simply the result of a too superficial teaching of physical chemistry for students of these disciplines. The author explains the details of redox potential measurements of reversible and irreversible systems, explains mixed potentials, etc. Finally, he makes some statements about the necessity to confirm the reversibility of redox systems in natural systems. Here he could have been much stronger in stating what systems are all irreversible, e.g. at platinum or gold electrodes. Figure 9.18 on page 358 is a very well-chosen illustration of the problems of redox potentials in natural waters. The author implicitly answers the question he asks in the heading; however, he could have answered it also explicitly.

All these equilibrium problems are very carefully worked out, with examples and well-chosen references to most recent publications as well as to those of historical significance. The author applied spreadsheet calculations, wherever this is appropriate. The illustrations are generally of high quality and substantially support the understanding. Each chapter is followed by a collection of exercises to calculate equilibrium systems. The results are not given in the book, which students may regret. I do not rate this as a deficit. It was a fortunate decision to orientate the content of the book on real systems of high importance, i.e. to include a detailed description of the equilibria of carbon dioxide, and of amino acids, to give only two examples. D.R. Cogley authors the twelfth chapter, which concerns "Automated computation methods". This is a very appropriate supplement. It is self-consistent and provides all necessary information to actively use commercial programs.

This is by far the best textbook on chemical equilibria I know. It is an absolute must for everybody using electrolyte solutions in his research. I wish the book a very wide distribution. Students should not hesitate to purchase a private copy and for libraries it is mandatory to have on the shelf.

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