

Thermodynamics and surface chemistry

Equilibrium in Solutions; Surface and Colloid Chemistry. By G. Scatchard. Pp. xxxv+306. (Harvard University: Cambridge, Massachusetts and London, 1976.) £20.40.

THE foundations of theoretical thermodynamics laid by Willard Gibbs represent a truly great intellectual and artistic achievement, perhaps marred a little for most of us by the feeling that it seems to require almost as much effort to understand or use or teach thermodynamics as we imagine to have been required for the original creation. George Scatchard devoted a lifetime of effort to the subject, understood it better than anyone else, and used it for a series of definitive research papers on the thermodynamics of complex systems, often systems of biochemical interest. He also taught a graduate course on the thermodynamics of solutions at MIT and an undergraduate course on surface and colloid chemistry. This book contains the text of lecture notes for these courses, originally prepared around 1950 and made available to students in mimeographed form. They were corrected by Scatchard before his death in 1973 and published in the present form with the aid of a grant from the Commonwealth Fund. Walter Stockmayer is quoted in the preface as stating that publication of a text 20 years after it is written "implies that it is unique and in some measure timeless", an assessment with which this reviewer fully concurs.

The goal of the section on *Equilibrium in Solutions* reflects the attitudes of the author's research papers. It is to be meticulously correct in theoretical concepts and equations, and at the same time to be completely practical in the sense that the discussion always focuses on real experimental data and procedures. There is no patience with theoretical "ideas" that do not relate to experimental measurement; on the other hand, when measurements are *more precise* than theory, then the theory must be empirically extended and it is important that the extension does not violate physical laws in simple limiting situations.

All the chapters are in a highly compressed style, difficult to read unless one is already somewhat familiar with the subject. But it is very rewarding once one gets the hang of it because all the essentials are actually there; in fact they stand out with greater clarity than they generally do in more comprehensive texts.

Electrolyte solutions are treated in greater depth than other topics, and

the treatment covers ion transport as well as equilibrium properties. The problems inherent to a definition of single ion activities are discussed, as are the various ways of extending the Debye-Hückel limiting law to higher concentrations. On the other hand, there is no mention of polyelectrolytes. Chemical equilibria are treated with extreme brevity (little more than a definition) and the reader will find no mention of practical aspects of treating chemical equilibria, such as are involved in 'Scatchard plots'.

The *Surface and Colloid Chemistry* section has six chapters: Introduction; Surface tension and interfacial tension; Polycomponent field surfaces; Adsorption on solids; Physical properties of colloid solutions; Electric effects at surfaces and in colloid solutions. It is even more compressed than *Equilibrium in Solutions*, being only 67 pages long, but again the essentials are there, with the notable exception that micellisation and other self-association processes are not considered. There are no literature references, so that these notes need to be read together with more modern texts (the plural is used advisably here because at least two separate texts will be needed to cover the material).

In addition to the scientific texts, we are provided with an appreciative introduction by I. Herbert Scheinberg, an

autobiographical note, and a list of Scatchard's publications. The major portion of the autobiography consists of a brief explanation for every paper listed in the bibliography, as befits a man for whom work was clearly a labour of love. Because of his own deep involvement, he had no patience with superficial science, and he labels a number of his papers as "polemics", designed to expose shallow thinking and fallacy. He also used book reviews as a vehicle for criticism, and both the reviews and the polemics are useful reading because the fundamental core of a subject, that Scatchard was always striving to reach, sometimes emerges especially clearly in relation to a point of contention.

This volume will have strong appeal to all who love to shape equations into a description of the real world (in preference to pictures), for it is the record of a man with unique facility for doing so. It also should be read by anyone who ever has to teach thermodynamics or surface chemistry, for it cannot help but sharpen his insight and ability to transmit it.

Charles Tanford

Charles Tanford is James B. Duke Professor of Physical Biochemistry at the Duke University Medical Center, Durham, North Carolina.

H. Mohr

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Hans Mohr is a natural scientist with a deep-rooted interest in the nature of scientific thought and in the significance of science. His first book on this subject entitled „Wissenschaft und menschliche Existenz“ was written in German (2nd edition, 1970). The present text is based on a series of 15 lectures which the author delivered at the University of Massachusetts during the fall term of 1975. In the Prologue "Science and Responsibility", some basic problems are formulated in more detail. While the treatment of the "Scientific Method" can already claim a well-established tradition of scholarship, the responsibility of the scientist has up to now only rarely been used in the consideration of the phenomenon of science. The author does not equate philosophy of science with epistemology, nor does he follow the tendency of excluding anything from consideration which might raise moral problems. Rather, the lectures on "The Ethics of Science", "The Crisis of Science" and "Science and Values" are as essential for the book as the epistemological treatment of "The Scientific Approach". Another characteristic of the book is that some traditionally epistemological problems, such as empiricism and rationalism, are investigated from the point of view of scientific knowledge.



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