

a deep pond where the oxygen at most amounts to only a few tenths per cent. of saturation. The entering water will come in contact with the air in the bottle and will undoubtedly absorb some oxygen. It has been found in our work that when the dissolved oxygen content of the water is very low it is always necessary to aspirate through the calibrated bottle *at least several times its volume* of the water in order to be sure that the first portions entering the bottle shall be completely displaced. In the apparatus described no provision is made for this and it will be evident that in such cases the results will not be accurate. The same criticism will apply, though perhaps not with the same force, to determinations of carbon dioxide made on samples collected in this way.

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NEW BOOKS.

GRUNDRISS DER QUALITATIVEN ANALYSE VOM STANDPUNKTE DER LEHRE VON DEN IONEN. BY DR. WILH. BÖTTGER. Leipsic. 1902. 250 pp. + 15 pp. of tables.

This book may be briefly characterized as an interpretation in detail of the usual scheme of qualitative analysis with the help of the Laws of Chemical Equilibrium and the Ionic Theory. It differs from Ostwald's "Scientific Foundations of Analytical Chemistry" in the respect that the theoretical principles involved are gradually introduced in connection with the analytical procedure, instead of as an introduction to it; and in the respect that it is intended to serve as a working manual for a course of qualitative analysis, rather than as an accompaniment to such a course. It differs from the recent treatise of Treadwell on the same subject in that it is far less extensive and complete on the experimental side, and in that the theoretical interpretation of the reactions is given greater prominence. In fact, the point of view from which the book is written would seem to make it fitted to teach laws and theoretical principles with the help of qualitative analysis, rather than qualitative analysis with the help of the principles. And, correspondingly, for the training of exact analysts, the book can not be said to be fully satisfactory; for the conditions for securing

certainly and delicacy in the tests are often not sufficiently indicated. Moreover, the directions for laboratory experiments are either so incomplete or so interwoven with descriptions and theoretical explanations, that some difficulty would be met with in the use of the book as a laboratory manual. In spite, however, of these and other defects in the manner of presentation, the book is a very valuable contribution to the science, and well deserves the attention of students, and especially of teachers, of the subject; for it represents the first systematic attempt at a detailed interpretation of the reactions of qualitative analysis from the standpoint of modern theoretical chemistry, carried out by an author who shows himself to be thoroughly familiar with the principles involved.

To illustrate more fully the character of the book, the following summarized statement of its contents may be presented. After a very brief introduction, the author describes the precipitation and separation of lead, silver, and mercurous mercury; discusses incidentally filtration, washing, the significance of solubility and equilibrium in general; and presents the fundamental hypothesis of the Ionic Theory,—unfortunately in a somewhat intangible form, since, following the practice of Ostwald, the author avoids using the concepts of the Atomic Theory. He then describes and interprets the important additional reactions of these metals, introducing the subject of complex ions and their effects in increasing solubility in connection with the silver-ammonia and silver-cyanogen compounds. The precipitation and separation of the metals of the hydrogen sulphide group are next described, theoretical explanations being interwoven with the procedure at each step. Incidentally, the Mass-Action Law in its general form is brought in, and is applied to the hydrogen sulphide precipitation. Additional reactions of the metals of the group are then discussed, and the varying degree of dissociation of different substances is referred to.

In connection with the succeeding groups of metals a similar plan is followed. The principles relating to oxidation and reduction, to the precipitation by ammonia of alkaline-earth phosphates, to hydrolysis, and to colloids, are treated under the aluminum and iron groups. Unfortunately, the solubility-product principle and the equilibrium-equation for dissolved electrolytes are not taken up till the calcium group is reached. By reason of

this fact the explanations of many points in the scheme of analysis for metals are so incomplete that much of the gain which should result from the application of the Ionic Theory is not realized.

The second part of the book is devoted to the detection and reactions of the acid radicals or anions. This part, consisting of sixty pages, is unusually thorough and complete. The dissociation-relations of the various acids, the subjects of catalysis and of fractional solution and crystallization, the principle of valence, and other theoretical considerations are introduced.

The third part of the book treats at length of the preliminary examination in the dry way, and of the methods of preparation of solutions for analysis. A number of special procedures adapted to the different insoluble substances are described.

A fourth part consisting of thirty-three pages, is devoted to the reactions of the rarer metals,—a subject too often neglected.

A set of tables, in the form of a separate pamphlet, summarizing the whole procedure, and intended for laboratory use, accompanies the book.

An English translation is in preparation, which will make this valuable work available for the use of elementary students.

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