

quate treatment. In discussing neutralisation, however, the author has fallen into a serious error. On page 178 we find in italics the statement that "when a base and an acid are mixed in equivalent proportions in aqueous solution they are transformed entirely, no matter how weak they may be, into a salt and water." This is undoubtedly erroneous. A solution of potassium cyanide, for example, is never neutral, but always contains free potash and free prussic acid. The author has been led into this error by assuming in the construction of his equations that water is a perfect non-electrolyte, *i.e.* is not at all dissociated into ions.

The chief defects of the book are the want of proportion already alluded to, and the too bare formal mode of treatment. Fewer formulæ and more text would better suit the requirements of the average student. The typography and clear arrangement of the mathematical sections of the work are admirable. It is to be regretted, however, that the text has not had the advantage of revision by a German proof-reader. The Dutch compositor is presumably responsible for some quaint specimens of German, and oscillates in his spelling between antiquated forms like "dasz," "nähmlich," and painfully phonetic renderings such as "grafisch" and "Kwadrat-wurzel."

The book may be confidently recommended to those who already know the elements of thermodynamics and are desirous to learn the applications of that science to the problems of general chemistry. J. W.

OUR BOOK SHELF.

Discussion of the Precision of Measurements. By Silas W. Holman. (London: Kegan Paul, Trench, Trübner, and Co., Ltd., 1892.)

THIS book deals with a subject that becomes more important every year, and its applications in nearly every science are both numerous and necessary. That our means of accurate measurement have reached a very fine stage, which is difficult to exceed, at any rate to a great extent, is well known, but results can be made of far greater value when subjected to a thorough discussion. In astronomy one may, perhaps, say that such discussions are carried through to their fullest extent and solving problems by the methods of least squares—a means of obtaining the most accurate values for the quantities sought after—is the rule and not the exception. To be able to find out the precision with which measurements have been made, whether by means of a yard-measure, the circle of a meridian instrument, or any other means, is at all times of great interest to the student of science, and the present work is intended especially as a course of study to engineers and for students of pure sciences, to present in a clear manner the principles on which such questions as, What accuracy is desired in the result? With what accuracy must each individual measure be obtained? and How trustworthy is the final result when obtained? &c., can be answered. The material here used is, as the author informs us, the outcome of several years' teaching of the subject, and a study of the volume itself indicates that he has presented it in a form that will commend itself to its readers. The book is divided mainly into three parts. The first deals with the treatment of direct measurements, the second with indirect, and the third with the determination of the best magnitudes of components. In the beginning the various sources

of error, in different kinds of measurement, are pointed out, and the reader is made familiar with determinate and indeterminate errors, deviations, general laws of deviations, &c., terminating with two fully-worked out examples relating to the balance and voltmeter calibration. Part ii. gives in a clear way the methods of procedure with regard to indirect measurements, several examples being interpolated illustrative of the rules described. The third and last part is devoted to the solution of a certain class of problems, which deal more with the use of the instruments with which the observations are made, than with the observations themselves. Thus, for instance, in using a tangent galvanometer to find the best angle of the needle which will give the least errors of reading. This and several other problems, taking the cases when there are one, two, three, or more components, are thoroughly worked out. The book concludes with a series of illustrative examples.

Traité Pratique d'Analyse Chimique et de Recherches Toxicologiques. Par G. Guérin. (Paris: Georges Carré, 1893.)

THIS book differs in several important respects from ordinary works on analytical chemistry.

The first three parts are concerned with the ordinary processes of qualitative analysis—wet and dry reactions, the separation of group precipitates, &c. As special features of these sections it may be noted that coloured representations of borax beads and of beads of microcosmic salt are supplied, and that the reactions of the rare metals and of acids such as bromic, selenic, butyric, malic, meconic, &c., which are but seldom introduced into text-books, are fully discussed.

After a short section dealing with the qualitative analysis of gaseous substances, the author deals with spectroscopic methods of analysis. In this part are described the various forms of spectroscope, and the modes of obtaining and observing both emission and absorption spectra. A table is given of the characteristic rays in the emission spectra of the different elements arranged in order of their wave-lengths. In connection with absorption spectra, chlorophyll, salts of didymium and erbium, potassium permanganate, and blood, including the treatment of blood-stains, are considered. Both emission and absorption spectra are illustrated by means of coloured charts.

Part vi., which is by far the most extensive, is devoted to toxicology. The conduct of chemo-legal inquiries in cases of suspected poisoning by arsenic, phosphorus, hydrocyanic acid, chloroform, and chloral are first given in detail. Then are considered the general reactions and, where devised, the modes of separation of the vegetable alkaloids and the alkaloids of animal origin, the ptomaines and leucomaines. This section is completed by a full and historical account of the characteristic chemical properties and physiological action of the principal alkaloids.

Quantitative methods only find a place in the last part of the book, where the author introduces the examination of potable and mineral waters, and the estimation of clays, irons, and steels. In this part the apparatus and methods used in the bacteriological study of water are also included. An appendix relating to the preparation and concentration of reagents and a full index are supplied.

The prominence given to the reactions of the rare metals, the introduction of spectroscopic methods, and in particular the chapters on toxicology, make the work a valuable addition to the literature on analysis. It may be noted, however, that when dealing with the constitution of substances like the alkaloids, the author occasionally uses formulæ which are as yet far from being definitely established.