

VALENCY.

The Theory of Valency. By Dr. J. Newton Friend. Pp. xiv+180. (London: Longmans, Green and Co., 1909.) Price 5s. net.

ALTHOUGH one may be inclined to criticise the inclusion of this volume in Sir William Ramsay's well-known series of text-books of physical chemistry, it is to be heartily welcomed on its own account, for there is no English treatise, and no very recent German one, dealing with the important subject of valency. The author's exposition is careful and thorough, dealing at length with the bearing of the periodic law on valency, and with the numerous, and in some cases fantastic, theories which profess to interpret the facts of chemical combination. Dr. Friend is not in a position to expound any one theory of valency which commands general acceptance; in the present state of our knowledge he can only put before the reader some half-dozen theories—Werner's, Abegg's, Ramsay's, his own, and others—to each of which exception may be taken in one respect or another.

The theory of constant valency, which had difficulty with the interpretation of the so-called "molecular" compounds, has, of course, been abandoned, and the authors of the newer theories vie with each other in postulating valencies of all sorts and conditions—"principal," "auxiliary," "normal," "contra-," and "latent." From the examples quoted in the book it will be seen that, according to the theory adopted and the particular compound under consideration, hydrogen may be regarded as mono- or di-valent, nitrogen as tri-, tetra-, or penta-valent, bismuth as di-, tri-, or tetra-valent, and chlorine as mono-, di-, tri-, or tetra-valent. Perhaps, however, the crowning example of departure from the older view of the constancy of valency is found in the suggestion, which has been brought forward in one quarter, that oxygen may have a valency of six or even twelve! The grounds on which a particular number is chosen to represent the valency of a given element are, indeed, frequently unconvincing, and after a perusal of Dr. Friend's volume one feels how much vagueness and arbitrariness there is about the whole subject.

In proportion as it is found necessary to admit the variability of valency, doubts arise as to the practical value of a doctrine of valency. It must be borne in mind that certain chemists have challenged even the contention on which is based the whole structure of modern organic chemistry, the contention, namely, that carbon is never anything else than tetravalent. The author, indeed, maintains that nothing is gained by assigning a variable valency to carbon, and prefers to attribute variability to other elements, such as oxygen, chlorine, and fluorine. But the argument that unless the valencies of carbon and hydrogen are limited to four and unity, respectively, the possibilities of formulation are indefinitely multiplied is not a weighty one. Equally unconvincing is a criticism of the interesting view that different grades of chemical union may exist; this view is characterised, not as unsound, but as "dangerous," a line of argument

that generally bespeaks a certain weakness in the defence.

The author is probably right in concluding that the solution of the valency problem is to be sought for on electrical lines, but at the same time he has done well to present to the reader everything which has a bearing on the subject, as, for instance, the new theory of Barlow and Pope, who regard valency from a non-electrical standpoint. It is only by a full and faithful presentation of conflicting facts and theories that the actual state of the problem can be rightly understood.

J. C. P.

ECONOMIC GEOLOGY IN BRITISH GUIANA AND SOUTH AFRICA.

- (1) *The Geology of the Goldfields of British Guiana.* By J. B. Harrison. With Historical, Geographical, and other Chapters by F. Fowler and C. W. Anderson. Pp. ix+320. (London: Dulau and Co., 1908.)
- (2) *The Ore Deposits of South Africa.* By J. P. Johnson. Part i., Base Metals. Pp. iv+61. (London: Crosby Lockwood and Son, 1908.) Price 5s. net.

THE history of gold mining in British Guiana dates from 1720, when an expedition was dispatched to Berbice in quest of gold. Further unsuccessful attempts were made at intervals, and modern mining in the colony dates from 1863. The first important success was gained in 1886, and mining regulations were enacted. The efforts were again commercially unprofitable, but some alluvial mining has always since been carried on. Quartz mining first attracted much attention in 1890, but none of the attempts was then commercially successful, because, Mr. Harrison tells us, the work was conducted recklessly, mills being erected before the mines had been adequately prospected. At length, in 1903, more judicious management was rewarded by success, and the mines on the Puruni River added British Guiana to the profitable gold-fields of the British Empire. The greatest yield was 138,000 ounces, in 1893-4, since when the yield has been slowly falling, until the output in 1906-7 was 85,000 ounces.

The first important contribution to the geology of British Guiana was the memoir by Brown and Sawkins, published in 1875 by the British Geological Survey. Since then various additions have been made to its mining literature, and an important series of contributions to its pure geology by its Government geologist, Mr. J. B. Harrison. He has now issued a valuable handbook to the geology of the colony, to which chapters on the history and geography are contributed by Messrs. Fowler and Anderson.

Mr. Harrison's monograph includes a detailed account of the geology and petrography of the country, which consists of a foundation of Archæan rocks, with intrusive series of granites and diabases, covered by a series of sandstones apparently of Algonkian age. Intrusive diabase and other basic igneous rocks are widely distributed; they are perhaps the most interesting rocks in the country, and, according to Mr. Harrison, are the source of most of the placer gold. The origin of the gold is discussed in an interesting