THE PRINCIPLES OF CHEMISTRY.

To most persons, and indeed to most chemists, chemistry is the science which has to deal only with the composition of bodies. No one can doubt the prime importance of the science regarded from this stand-point; but it may fairly be asked whether the determination of the composition of bodies is the final object of chemistry, even if by composition we mean not only the kinds of matter of which the bodies are made up, but the arrangement of their smallest particles.

The determination of composition in this broad sense forms the principal work of the chemists of the present generation, and of many generations past. In a rough way, to be sure, attempts have been made to discover the laws which govern the changes in composition which bodies undergo, but our knowledge of these laws is as yet extremely limited. It is the discovery of these laws which forms the highest object of chemistry. It is one thing to know, that, when hydrogen and oxygen are brought together under certain circumstances, water is formed, and that under certain other circumstances water can be decomposed into hydrogen and oxygen. It is another thing to know something about what takes place in the interval between the disappearance of the hydrogen and oxygen and the formation of the water, or *vice versa*. We have here to deal with a natural phenomenon, which should be studied as other natural phenomena are studied; as, for example, the falling of bodies, etc. Suppose that in studying the falling of a body we should confine our attention to the body at rest before it falls, and after it has fallen, how extremely imperfect our knowledge of the phenomenon would be! It is plain that we could never discover the laws of falling bodies by such observations; and yet our observations in the case of chemical phenomena are almost exclusively of this kind. The reason is, that chemical action usually takes place so rapidly that it is practically impossible to make accurate observations during its progress. Of late, however, there has been a marked tendency to the study of the course of chemical reactions; and the indications are clear that chemists are beginning to give the subject of chemical action as such more serious attention than has heretofore been the case.

The book before us has largely to deal with the recent developments in the scientific study of chemical phenomena, and with well-known facts and hypotheses which have a bearing upon the deeper problems of chemistry. In his zeal for the new work, the author is perhaps now and then unfair towards the old; but in general he gives evidence of a spirit of fairness, and a desire to weigh conscientiously the facts and the inferences which they seem to permit. As regards the subjects treated in the book, we quote from the preface: —

> "The book is divided into two parts. The first part is occupied with the statement and discussion of the atomic and molecular theory, and the applications thereof to such subjects as allotropy, isomerism, and the classification of elements and compounds. Somewhat full accounts are also given, in this part, of thermal, optical, and other departments of physical chemistry, in so far as the results and methods of these branches of the science are applicable to the questions regarding the composition of chemical systems which are connoted by the term 'chemical statics.'
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> "The second part of the book is devoted to the subjects of dissociation, chemical change and equilibrium, chemical affinity, and the relations between chemical action and the distribution of the energy of the changing system. These and cognate questions I have ventured to summarize in the expression 'chemical kinetics.'"

The first part gives us a clear treatment of the subjects of atoms and molecules, and the structure of molecules. The chief characteristic of the author's method of treatment is an absence of dogmatism, and a clear determination to be governed by facts, and not by hypotheses. We commend this part of the book to advanced students of chemistry who have become contaminated with the dogmatic methods which are so much in vogue. We earnestly beg our teachers to study it, and, if possible, to profit by it.

In the second part of the book are found chapters on subjects which are not commonly treated in text-books of chemistry. The researches of Guldberg and Waage, and of Ostwald, of Pfaundler, Horstman, and Willard Gibbs, are fully and clearly treated for the first time in a chemical text-book in the English language, and treated in such a way as to convey a correct idea in regard to the relations of the various investigations to the general problems of chemistry. The chapter on affinity is worthy of special mention and of special study.

It may be questioned whether, in his views regarding valence and structure, the author does not allow himself to be carried too far. Thus, p. 463, we read, —

> "When . . . we do not know the molecular weights of compounds in the state of gas, conclusions regarding the structure of the molecules of these compounds are very apt to degenerate into

A treatise on the principles of chemistry. By M. M. PATTISON MUIR, M.A., F.R.S.E., fellow and praelector in chemistry of Gonville and Caius college, Cambridge. Cambridge, *University press*, 1884. 24+488 p. 8°.

mere exercises of the fancy. Indeed, the use of the expression 'structure of molecules' is in such cases quite unwarranted."

There is undoubtedly a sense in which the last statement is true, but there is another sense in which it is not true. We may know a great deal about the chemical conduct of a compound, — enough, indeed, to warrant us in partially expressing its structure in a formula, without positively knowing its molecular weight. The reason why "conclusions regarding the structure of the molecules . . . are very apt to degenerate into mere exercises of the fancy," is not so much that the molecular weights are unknown, but rather that the true signification of structural formulas is not understood, and formulas are frequently constructed on an entirely inadequate basis of facts.

Taken all in all, the book is deserving of the highest praise, and its influence can only be beneficial. It will arouse opposition, but it will at least cause those who oppose it to think; and, if it should do this, it would be of value, though every word were false.

NOTES AND NEWS.

MR. H. L. BIXBY of Chelsea, Vt., is taking steps to introduce a system of weather warnings throughout his state by means of blasts from factory-whistles. The signals are as follows: after the first long, unbroken blast, usually given at about seven A.M., a single five-second blast indicates fair or probably fair weather for the day; two blasts, foul weather; three, fair changing to foul; four, foul changing to fair; five, doubtful or irregularly variable. After any of these, five short blasts signify a cold wave or unseasonable frosts. The managers of the *Free press* at Burlington undertake to send the necessary telegrams on payment of a small fee. Randolph is the first town to adopt the system: the signals are regularly given there now from a ten-inch steam-whistle.

— Herr J. Brautlecht has been experimenting on the transfer of bacteria from the soil to the atmosphere. Ignited sand, gravelly soil, and a moderately clayey garden-soil, were moistened with liquid containing bacteria, and covered with glass bells. In a few hours microbia of the same kind as those contained in the liquid were found in great numbers in the moisture condensed on the sides of the bell. It will be remembered that Angus Smith was one of the first to point out that aqueous vapor condensed on the walls of rooms contains micro-organisms.

— The Nitrate owners' committee of Tarapaca have determined to offer a prize of a thousand pounds for the best essay on the employment of nitrate in agriculture, so as to supplant other fertilizers. The essay is to be published by the committee in all modern languages. Moreover, five hundred tons of nitrate, subscribed by the manufacturers, are to be shipped to Europe and the United States, to be employed in experiments at the expense of the committee. A fund of four thousand pounds has been formed to carry out these various schemes, the object of which is to promote a demand for the nitrate.

— Dr. Edward Divers, principal of the Imperial engineering college of Tokio, Japan, writes to the *Chemical news*, informing the editor of a serious accident which threatens to deprive him of the sight of one eye. He is anxious to put chemists and others on their guard. A bottle containing phosphorus trichloride had done duty for many years as a specimen for the lecture-table. Dr. Divers was carefully warming the neck of the bottle to liberate the stopper, when the bottle burst in pieces with great violence, the cornea and iris of the right eye being extensively wounded, and the aqueous humor discharged.

— A sensation has been caused in Australia by the discovery of the gold-field at Mount Morgan, near Rockhampton, in Queensland. The mine, it is estimated, contains gold enough to yield, after working, a profit of nine million pounds. The curious fact is that the locality is not one which a geologist would have pointed out as likely to contain gold. The theory put forward to account for the presence of gold there is that it is a secondary formation. The gold is not in the original matrix. Nature has already mined it, chemically treated it, sublimated it, and redeposited it. The discovery is likely to give a stimulus to 'prospecting' in Queensland, and also in the other colonies.

— Professor Woldrich, at a recent meeting of the Vienna anthropological society, read a paper on the latest prehistoric remains found at Prerau. Several cartloads of bones had been found there while workmen were levelling for an orchard, and taken to the Olmütz museum. They were principally bones of mammoths, cave-bears, foxes, hares, etc.; but mingled with them were flint weapons, and some of the bones bore traces of being worked and cut. Charcoal was also found in the surrounding earth.

— The board of commissioners in charge of the lights on the coast of Scotland suggest that in cases of fog, when a light cannot reach its usual distance, the beam from a powerful source, such as electricity, might be depressed so as to concentrate the intensity on the near-hand sea by slightly moving the flame out of the focus of the apparatus, and supplementing it by the use of suitable reflectors. They also look upon the question of the relative absorption of electric light by fogs, compared with that of light from other sources, as yet undetermined, and requiring strict investigation.

— The brewers' journal, published in Nuremberg, the *Allgemeine brauer- und hopfenzeitung*, celebrates its twenty-fifth anniversary by offering prizes for two essays on, 1°, The culture of hops; 2°, Barley as brewing-material: the best essay to receive a prize of fifty pounds; the essay, in German, to be sent in to the editor before May 1, 1886.