HINRICHS' CHEMISTRY

The Elements of Chemistry and Mineralogy, by Gustavus Hinrichs, A.M. (Griggs, Watson, and Day, Davenport, Iowa, U.S.)

THIS is the second volume of Prof. Hinrichs' series of science instruction for schools. In the former volume the elements of Physics were given ; this volume contains the elements of Heat, Chemistry, and Mineralogy, and will be followed by a third, called the "Students' Cosmos." The author has thrown himself entirely into the practical method of teaching the physical sciences—the student has first to perform an experiment, and then draw his own deductions from it. In chemistry, perhaps, more than in the other sciences, this system leads to the best results ; for on all sides laboratory practice is recognised as essential to its true understanding. If, however, large laboratories and costly apparatus are required, its introduction in our schools cannot become universal. The author has, however, shown in this volume that by excluding special branches, a considerable knowledge of the elementary methods of laboratory practice may be furnished, almost free of charge, by any school to all its pupils. At a time when science instruction in our schools is attracting so much attention, a series of volumes like the present is peculiarly valuable, and thanks are due to Prof. Hinrichs for his bold effort to show how the physical sciences should be taught.

The subject "Heat" occupies two chapters. The first deals with the sources of heat, modes of heating, radiation and induction, thermometry, calorimetry, and fusing and boiling ; the second treats of the relation of heat to mechanical work. These are extremely clear and practical ; we think better than those which follow. The third chapter is on "Dissociation and Electrolysis." After a few examples of the splitting up of compounds into their elements have been studied, the student is led naturally to the definitions of elementary bodies, of compounds, and mixtures. The next chapter is confined to the elements and compounds, and some of the principles of chemical nomenclature ; to this chapter we must certainly take exception, the author has introduced a novel and arbitrary classification of the elements, which, we think, will tend to confuse the student. He groups the elements into nine genera, giving the characteristic properties of each : thus we have the kaloids, analogous to potassium ; calcoids, analogous to calcium ; cuproids to copper, and so on ; under the last head we find classed, copper, silver, gold. We cannot see any reasons for such grouping, for neither in their chemical nor in their physical properties do these three elements correspond.

The author divides chemical substances into monaries, binaries, ternaries, and serials ; the monaries are the elements themselves, the binaries the compounds of two elements, the ternaries of three, whilst the serials comprise organic bodies ; there is, however, no reason in the author's definitions why the greater number of the serials should not be classed under the ternaries. The term "serials" the author has taken from the fact that numerous organic compounds can be classed together to form series of substances, differing from each other by a definite increment. The next chapter treats of the synthesis of acids and bases, and chapter 6 is devoted to chemical processes. Under the head of "substitution," the quantitative relations of the elements to each other are brought out. We do not think, however, that the difference between the terms "atomic weight" and "equivalent" is by any means sufficiently defined. A considerable space is devoted to the phenomena of double decomposition and to the complex processes, such as fermentation, &c., which concludes the chemical portion of the work. A chapter on mineralogy follows, but on this it will be difficult to give an opinion, as the method the author uses is novel, but, according to his account, quite satisfactory. The book on the whole is most carefully written, so that the student cannot fail in his experiments provided he follows his instructions ; these also are so given as to lead to economical and precise methods of working. At the end of the book a number of blank pages are left for the pupil to fill up with his notes of experiments performed, and results obtained, forming quite a new feature in this class of works. The chapter on the "Chemical School Laboratory" we should recommend to the notice of our teachers, as it gives a description of the author's system of teaching, which, we believe, has succeeded extremely satisfactorily in the case of physics, and, we trust, will be equally successful in chemistry.

OUR BOOK SHELF

The Figure of the Earth. By Archdeacon Pratt. (4th Edition. London : Macmillan and Co.)

THIS is the fourth edition of a well-known book, of which we shall unfortunately not now have any more new editions from the hand of its lamented author. The book has grown much since its first edition as a separate work in 1860. The chapter on the attraction of table lands, mountains, oceans, &c., has been much enlarged since the first edition, and also the chapter on the determination of the figure of the earth by geodetic operations. A chapter, most valuable to the student of physical mathematics, is inserted on the determination of the ellipticity of the earth (considered as a body whose surface is one of its own equipotential surfaces) from pendulum experiments, the moon's motion, and the precession of the equinoxes, respectively. The student of this subject must carefully bear in mind that no observations taken exterior to the surface of the earth can throw any light whatsoever on the internal arrangement of its matter, inasmuch as, according to the well-known theorems of Gauss, there are an infinite number of ways in which that matter might be conceived as being arranged so as to produce the same external effect. The observations above noticed, however, are calculated to throw light on the question as to whether the surface may, within the limits of approximation, be considered as a surface of equilibrium.

In fact, it is known that in any event the external effect of the earth may be precisely effected by the distribution in a concentrated form of the whole matter of its interior over its surface.

The important proposition that any function, which does not become infinite within the limits considered, can be expanded in a series of Laplace's functions, is proved by Mr. Pratt in the text by rather a long method, in order to get over a certain apparent objection as to discontinuity. The following proof of that proposition seems short, and not open to objection.

Let A and B be two points on a sphere of centre O. Let the co-ordinates of any point R referred to A be p and q, where p is the cosine of the angle between OR and OA,