only by measurements of absolute exactness. Just as we are content to accept a small piece of smooth water as level, although we know from measurements of large surfaces of it that it is curved, so we must be content to take Euclid's geometry as true within the limits of error of ordinary measurements. It may be that we shall be able to arrive at such a precision of measurement of the very large or the very small as to prove Euclid's geometry false; we can only prove it true by arriving at infinite precision of measurement, which can never be.

It is interesting to note the effect of this discovery upon the position of Euclid as a mathematician of ability. It has raised him to a position higher than it had ever been supposed possible to place him, for his work shows that he knew something of this science of absolute space—how much may never appear, but certainly enough to make him the original progenitor of it. Certain portions of Euclid have long been considered as blemishes in an otherwise remarkable book. His treatment of proportion has been discarded in modern geometries as too prolix and heavy. His treatment of parallels has been regarded as unscientific, and would-be authors, bent on showing their ingenuity and superiority to Euclid, have adopted other methods which they claimed were more satisfactory. But when a man like Bolyai appears, whose genius is comparable with that of Euclid, he brushes the dust of ages from these blots, and behold, they shine as gems of purest thought, whose brightness and depth confound and dazzle his would-be improvers! After all, it takes a long time for scientific knowledge to spread, and doubtless there will continue to be many authors who will write geometries with so-called modern improvements that proclaim simply their authors' ignorance of the elements of Euclid and the science of space.

Many editions and different points of view of Non-Euclidean gometry have been presented by modern authors, such as Cayley, Clifford, Riemann and others. Of American workers on the subject we have Dr. Halsted who has been interested on the historical side, dating probably from his Bibliography of the subject prepared for the *American Journal of Mathematics*, while a Fellow of the Johns Hopkins University. We may expect much more new and valuable material from him in this line. Dr. Story, of Clark University, has also written for the same journal in line with the labors of Cayley, Clifford and other European mathematicians. One remarkable feature of the later developments is that the various non-Euclidean geometries may be interpreted as the forms in which Euclidean geometry itself would appear, depending upon the meaning of those vexatious quantities '*distances*,' '*angular measurements*,' *etc.*

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Elementary Meteorology for High Schools and Colleges. By Frank Waldo, Ph.D. New York, Cincinnati and Chicago, The American Book Company. 1896. Pp. 372.

Another *Elementary Meteorology* is added to the list of recent works under that same title. This one is by Dr. Frank Waldo, of Princeton, N. J. Dr. Waldo was formerly connected with our Signal Service (the predecessor of the present Weather Bureau) as Junior Professor of Meteorology, and in that capacity gave instruction in meteorology to the officers and men of the Service. His experience then gained, and his intimate acquaintance with the modern German writings in this science, should have qualified him well for the preparation of a text-book of meteorology. This volume is designed, as is stated on the title-page, 'for High Schools and Colleges,' and, as appears in the preface, 'is intended to serve as a text-book of the elements of the science for general students, and must not be considered as a manual for practising meteorologists.' The book will doubtless have a large sale. It gives a good general view of the science; it is of convenient size, well printed, fairly well illustrated and, a very important matter, it is published at a moderate price. The general plan of the book is similar to that of most of the other text-books, so that there is no occasion for comment on this score, but the chapter on the general circulation of the atmosphere is more complete than usual. Dr. Waldo has succeeded in putting Ferrel's ideas on this subject into tolerably simple lan-

guage, which is by no means an easy task. The last chapter, on the climate of the United States, is also quite extended, and will prove useful.

We might state our opinion of the volume in the following words: It is good, but it is not an *elementary* meteorology. Our author has succeeded in condensing a very great deal of information into his 372 pages, but for our part, we do not consider the book adapted for use in high schools. Some of the chapters can be easily understood, but certainly many of them would be difficult for anyone to appreciate thoroughly unless a pretty careful study of meteorology had preceded. Take, for instance, the chapter on the general circulation of the atmosphere, which, as already stated, is well done. We wish we could believe that our high school students, or even many of our college students, could thoroughly master that. We think our author has made a mistake in attempting to put so much information into this one volume, if his intention is to give an elementary presentation of the subject. It would be better to treat fewer matters, and to take each up at some length, than to attempt to include so many topics and necessarily dismiss many of them with a few words only. An elementary meteorology adapted to school use still remains to be written. Such a book, according to our way of thinking, should not attempt to cover nearly so much ground as has hitherto been the practice of writers of 'elementary' text-books of meteorology. It should devote far more attention to the instrumental side, to the study of weather maps, and to individual observations, both with and without instruments. Only after some such truly elementary knowledge concerning local phenomena has been gained can the student fully appreciate the larger facts which the general temperature, pressure, wind and rainfall conditions of the globe present.

What has been said regarding the non-elementary character of Dr. Waldo's book should not operate in the mind of the reader to detract from any of its merits as a text-book for the use of more advanced students. It will undoubtedly be widely read, and do a good work in disseminating sound meteorological learning.

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Lecture Notes on Theoretical Chemistry. By FERDINAND G. WIECHMANN, Ph. D., Columbia College. Second edition. Revised and enlarged. New York, John Wiley & Sons. 1895. 8°, pp. xviii+288.

The apparently growing tendency to divorce practical and theoretical chemistry is probably unfortunate for the training of the next generation of chemists. To study chemical phenomena without studying the principles of chemistry is much like relegating the student to the days when these principles were unknown; yet, in many of our modern text-books, every effort seems made to eliminate theory, as far as possible, and carry chemistry back to where botany was a few years ago, the study of a sufficient number of plant forms to enable the student to 'analyze' a flower. True, when one has acquired a good knowledge of general chemistry by several terms of study, it is desirable to go over the theoretical ground again and more extensively than it can be done in an elementary course, and for this purpose there are a number of excellent works not only in German, but also in English, and one at least by an American. Professor Wiechmann's work, however, covers a more elementary ground and is well fitted to accompany, rather than to succeed, college work on general chemistry. While it consists of 'Lecture Notes,' it is fuller than this title would indicate and might well be called an Elementary Treatise on Theoretical Chemistry. Undoubtedly, it would be a great advantage for a student to have before him the original lectures of which this book gives the notes; nevertheless the subject is set forth so clearly that the book has an independent value even as a text-book. It would be very helpful for all teachers of chemistry in secondary schools to have a good knowledge of its contents, and would be a great advantage to their teaching.

Chapter I. treats of matter and its forms, including solutions and change of state; chapter II. of the measurement of matter and specific gravity. The various methods of taking specific gravity and density are well classified and briefly described. Chapter III., the science of chemistry, is a brief introduction. Chapter IV., on chemical nomenclature and notation, is