instead of

$$\frac{\sin \pi/2}{\pi/2} = \frac{1}{1.57}$$

$$\frac{\sin \pi/2}{\pi/2} = \frac{0}{1.58}.$$

In carrying out his purposes, the author has very properly included a brief treatment of exact and inexact differentials, Fourier's series, and the application of imaginary numbers to the solution of some differential equations that are important in mathematical physics.

The final chapter of the book is devoted to directions for the representation of experimental data by mathematical functions, but the presentation is so brief that it is doubtful if the biologist or chemist could carry the directions into numerical effect without more mathematics than is given in this book.

On the whole, the author has shown good judgment in the selection of material for his purposes, and the biologist and chemist not familiar with the calculus will find the book of value.

H. L. RIETZ

Radioactive Substances and Their Radiations. By E. RUTHERFORD. Cambridge, University Press. 1913. Pp. vii + 700. Price, $4.50.

The subject of radioactivity is now just sixteen years old, yet the volume of its literature already compares favorably with that of any of the other grand divisions of physics and two compendious text-books, Rutherford's and Madame Curie's—not to mention a host of less pretentious treatments—are available to initiate the student into its mysteries.

It is now eight years since the second edition of Rutherford's "Radioactivity" appeared, and in view of the fact that this period covers one half of the life of the science, it is scarcely to be expected that its present status could be adequately presented by a mere revision of that book. And it is to the author's credit that he has not attempted to patch the new material into the old frame, but has instead built an entirely new framework and merely utilized the old lumber wherever it still proved serviceable.

Out of a total of 700 pages, only about 150 are taken from the former work. Despite this fact, the present book makes very much the same impression as did its predecessor, whether it is given merely a cursory glance or whether it is made the subject of careful study. This is because the big problems of radioactivity were correctly solved at the start, and that largely by Rutherford himself. It is one of the most notable facts connected with this notable subject that within eight years of the discovery of the first radioactive rays, the phenomena of radioactivity should have been so thoroughly worked out and so unerringly interpreted that scarcely a viewpoint then taken in a book of 560 pages needs, after eight more years of exceedingly active experimenting, to be discarded.

The differences between the old book and the new are to be found not so much in method of treatment or in order of presentation, as in the incorporation of the new material which has accumulated within the past eight years. Much of this material has grown out of researches conducted in Rutherford's own laboratory. The additions have come chiefly from the careful study of the following subjects, none of which are found in the old text.

1. The range of the alpha particle, the law of its scattering in passing through matter, and the stopping power of substances for it. Through studies in these fields has come a great addition to our knowledge of the nature of the atom and the character of radioactive changes.

2. The phenomena of recoil, undiscovered when the old book was written, but recently diligently studied and shown to be invaluable as a means of separating radioactive products.

3. The methods of directly counting the alpha particles, one of which, namely, the scintillation method, has recently been of great help in the study of the short-lived products.

4. The scattering and change in velocity of the Beta rays in passing through matter and the remarkable resolution into a large number of homogeneous components of the Beta rays emitted by Radium *C*—studies which have thrown new light on the nature of the atom.

5. The connection between the Beta and the Gamma rays, the recent investigation of which has raised new and interesting questions regarding the nature of electro-magnetic radiation itself.

6. The elaborate study of the thorium and actinium series of products, a study which has been chiefly responsible for the extension of the twenty radioactive products known in 1905, to the thirty-two known in 1913.

7. The new evidence for and against the activity of ordinary matter.

8. The bearing of radioactivity upon the age of the earth.

The author's style is always direct and simple and the present book, like its predecessor, can be read by those not trained in severe mathematical analysis. At the same time, the work of compiling has been carefully and thoroughly done, the references to the original articles are complete, and the author has been remarkably successful in dealing fully and fairly with the work of other investigators and in making a thorough and complete presentation of the facts and theories of radioactivity as they stand in the year 1913. This book will undoubtedly be the standard work on radioactivity for the next five or six years at least.

<div style="text-align:right">R. A. MILLIKAN</div>

UNIVERSITY OF CHICAGO,
   RYERSON PHYSICAL LABORATORY,
      June 2, 1913

SCIENTIFIC JOURNALS AND ARTICLES

THE April number (volume 14, No. 2) of the *Transactions of the American Mathematical Society* contains the following papers:

J. L. Coolidge: "A study of the circle cross."

W. W. Denton: "Projective differential geometry of developable surfaces."

K. P. Williams: "The solutions of non-homogeneous linear difference equations and their asymptotic form."

A. B. Coble: "An application of finite geometry to the characteristic theory of the odd and even theta functions."

W. F. Osgood and E. H. Taylor: "Conformal transformations on the boundaries of their regions of definition."

THE May number (volume 19, number 8)

of the *Bulletin of the American Mathematical Society* contains: Report of the February meeting of the Society, by F. N. Cole; "Three or more rational curves collinearly related," by J. E. Rowe; "Second note on Fermat's last theorem," by R. D. Carmichael; "An extension of a theorem of Painlevé," by E. H. Taylor; "Mathematical physics and integral equations," by W. A. Hurwitz; "Shorter Notices": Schulze's Teaching of Mathematics in Secondary Schools, by J. L. Coolidge; Hime's Anharmonic Coordinates, by J. V. McKelvey; Beutel's Algebraische Kurven, Zweiter Teil, by H. S. White; Scheffer's Lehrbuch der Mathematik für Studierende der Naturwissenschaften und der Technik, by A. R. Crathorne; Sainte-Laguë's Notions de Mathématiques, by R. C. Archibald; Weber and Wellstein's Encyklopädie der Elementar-Mathematik, Band III., by J. B. Shaw; Whittaker's History of the Theories of the Æther and Electricity, Krause's Theorie der elliptischen Funktionen and Mill's Introduction to Thermodynamics, by E. B. Wilson; Annuaire du Bureau des Longitudes pour l'An 1913, by E. W. Brown; "Notes"; "New Publications."

The June number of the *Bulletin* contains: Report of the spring meeting of the Chicago Section, by H. E. Slaught; "Concerning two recent theorems on implicit functions," by L. L. Dines; "Concerning the property Δ of a class of functions," by A. D. Pitcher; "The asymptotic form of the function $\Psi(x)$," by K. P. Williams; "An erroneous application of Bayes' theorem to the set of real numbers," by E. L. Dodd; "Shorter Notices": Weber's Partielle Differential-Gleichungen der mathematischen Physik, Band II., and Föppl's Theorie der Elektrizität, Band I., by J. B. Shaw; "Notes"; "New Publications."

SPECIAL ARTICLES

ACCESSORY CHROMOSOMES IN THE PIG

SEVERAL points of interest were brought to light in this study of the spermatogenesis of the pig and the relation of the accessory chromosomes to sex. Unusually good material was available for this investigation and it was found that eighteen chromosomes occur in the