XIII. The statement of the principle of Gibbs and its bearing on the behavior of gaseous mixtures is treated with exceptional clearness, and the fundamental fact that the theory of such mixtures depends on only three laws (those of Mariotte, Joule, and Gibbs) is so emphasized that no reader can miss it or fail to see its significance.

E. B. WILSON.

NOTES.

THE opening (January) number of volume 29 of the *American Journal of Mathematics* contains the following papers: "The groups which contain less than fifteen operators of order two," by G. A. MILLER; "Concerning the improper definite integral," by N. J. LENNES; "On the congruence of axes in a bundle of linear line complexes," by O. P. AKERS; "On septic scrolls having a rectilinear directrix," by C. H. SISAM. This number also contains a portrait of Professor DAVID HILBERT, of the University of Göttingen.

The April number contains: "Beiträge zur nicht-euklidischen Geometrie, I, II, III," by E. STUDY; "Certain triply orthogonal systems of surfaces," by L. P. EISENHART.

THE April number (volume 8, number 3) of the *Annals of Mathematics* contains: "Note on the use of group theory in elementary trigonometry," by G. A. MILLER; "The asymptotic lines on the anchor ring," by M. B. WHITE; "On certain theorems of mean value for analytic functions of a complex variable," by D. R. CURTISS; "Note on regular polygons," by C. A. SCOTT; "The revolution of a dark particle about a luminous center," by E. B. WILSON.

AT the meeting of the London mathematical society, held on March 14, the following papers were read: By G. W. EVANS-CROSS, "Exhibition of a new calculating machine"; by T. STUART, "On the reduction of the factorization of binary septans and octans to the solution of indeterminate equations of the second degree"; by L. E. DICKSON, "Invariants of the general quadratic form modulo 2"; by J. BRILL, "On partial differential equations of the first order."

THE regular spring meeting of the Association of teachers of mathematics in the Middle States and Maryland was held at Teachers College, Columbia University,, on Saturday, April 6, 1907. The following papers were presented : By W. H. MALT-BIE, " Zero and infinity " ; by GEORGE H. HALLETT, "Some problems in the teaching of elementary mathematics " ; by D. E. SMITH, " The history of computation," with stereopticon illustrations ; by W. E. STARK, " The use of certain ancient instruments in the modern teaching of geometry and trigonometry," with stereopticon illustrations.

AT the meeting of the Rochester section of the Association of teachers of mathematics in the Middle States and Maryland, held at the University of Rochester on April 13, 1907, the following papers were read : By W. P. DURFEE, " Elementary algebra " ; by M. M. WARDWELL, " Elementary algebra as a preparation for the study of algebra " ; by E. D. GRABER, " Graphical representations in algebra " ; by C. C. WILCOX : " The method of limits."

THE list of members of the Deutsche Mathematiker Vereinigung, published in the January number of the *Jahresbericht*, contains 690 names, including 63 Americans ; the financial report shows a credit of nearly 20,000 marks. The Vereinigung is now completing its seventeenth year, having been founded in 1890 at the Bremen meeting of the society of German naturalists and physicians. It immediately began the publication of the *Jahresbericht*, which contained each year in addition to the list of members, the financial statement, and an abstract of the papers read at the annual meeting, a comprehensive report of some branch of mathematics. Twelve well-known reports have now appeared in ten volumes of the first series, and another will soon be issued. In 1893 the Vereinigung prepared the extensive exhibition of models and apparatus at Munich, also shown later in Chicago at the Columbian exposition, and in 1894 it definitely formulated the plan of the Encyklopädie der mathematischen Wissenschaften. Upon the appearance of the earlier parts of this work, the preparation of further yearly reports was discontinued, the same ends being attained by the Encyklopädie. In 1902 the *Jahresbericht* began to appear as a monthly publication, somewhat similar to the BULLETIN. In 1904 the Vereinigung primarily conducted the third international congress of mathematicians at Heidelberg, and published

its proceedings. During the last few years it has also been influential in bringing about important changes in the programme of the gymnasia and other preparatory schools. At the forthcoming meeting, to be held in Dresden, September 15–22, further questions of pedagogy will be considered and plans perfected for providing a suitable place for its extensive library and especially for preserving valuable manuscripts. The officers for the present year are : president, Professor A. VON BRILL ; secretary, Professor A. KRAZER ; editor of the *Jahresbericht*, Professor A. GUTZMER.

THE educational museum of Teachers College of Columbia University announces the preparation of nearly 200 lantern slides of illustrations useful in teaching the history of elementary mathematics. The slides will be furnished only to schools and colleges, or to those who give courses in such institutions, at cost, which is forty cents per slide. No order for less than twenty-five slides can be filled. For the list of subjects and all other information concerning them, letters should be addressed to the Educational Museum, Teachers College, Columbia University, New York City.

UNDER the title of *Revue trimestrielle de Mathématiques pures et appliquées* a new mathematical publication is about to appear, edited by E. Weber, Liège, Belgium. Its pages are open to meritorious papers in pure mathematics, hypergeometry, mechanics, and elasticity. The price per volume of 300 pages is 15 francs.

THE scientific society of Harlem announces the following prize problem for 1908 : " To determine how $p_1 N$ spheres of radius R_1 and $p_2 N$ spheres of radius R_2 (N being undetermined) should be placed to occupy the least space? When p_1, p_2 are known, what are the critical relations between R_1, R_2 such that by making a slight variation of this relation an entirely different distribution of the spheres results? Partial results, limited solutions, particular cases, etc., will be considered. Competing memoirs should be sent to Dr. J. Bosscha, Harlem, Holland, under the usual conditions, before January 1, 1908. The value of the prize is 500 gulden. The winner may choose between the cash value and a gold medal.

THE subject of the next Adam's prize problem, to be awarded in 1909, is " To discuss the radiation from electric systems or

ions in accelerated motion and the mechanical relations on their motion which arise from it." Competition is open to anyone who has taken a degree at Cambridge University. Memoirs should be submitted to the vice-chancellor before December 16, 1908.

AMONG the Smith prizes for the present year, the two following were awarded for mathematical essays: To A. S. EDDINGTON, "The systematic motions of the stars," and to J. W. NICHOLSON, for his essay "The bending of waves around a large opaque sphere and some associated problems."

DURING the year 1906 the following doctorates with mathematics as major subject were conferred by the University of Paris: (Doctoral d'État.)   CARRUS, "Familles de surfaces à trajectoires orthogonales"; M. FRÉCHET, "Sur quelques points du calcul fonctionnel"; LATTÈS, "Sur les équations fonctionnelles"; FAYET, "Recherches concernant les excentricités des comètes"; SAINT BLANCAT, "Action d'une masse intramercurielle sur la longitude de la lune" — (Doctorat d'Université.) REMOUNDOS, "Sur les zéros d'une classe de fonctions transcendantes."

THE following courses in mathematics are announced for the summer sessions of the several universities:

UNIVERSITY OF CHICAGO (summer quarter, June 15 to September 15). — By Professor E. H. MOORE: Graphical methods in algebra especially for teachers, five hours; Theory of determinants, advanced course, four hours; Seminar, two hours. — By Professor O. BOLZA: Theory of functions of a complex variable, four hours; Problems in the theory of functions, two hours; Abelian functions, two hours. — By Professor H. E. SLAUGHT: Integral calculus, five hours; Differential equations, four hours. — By Professor L. E. DICKSON: Trigonometry, five hours; Solid analytic geometry, five hours; Continuous groups, four hours. — By Professor F. R. MOULTON: Descriptive astronomy, five hours; General celestial mechanics, five hours. — By Professor K. LAVES: Descriptive astronomy, five hours; General astronomy with laboratory work, five hours. — By Dr. A. C. LUNN: Curve tracing and differential calculus, five hours; dynamics of oscillatory systems, four hours. — By Mr. N. J. LENNES: Plane analytic geometry, five hours;

Critical review of secondary mathematics, four hours. — By Professor G. W. Myers : Pedagogy of elementary school mathematics, five hours ; Pedagogy of secondary school mathematics, five hours.

COLUMBIA UNIVERSITY (summer session July 9 to August 17). — Py Professor JAMES MACLAY : Differential calculus, five hours ; Differential geometry, five hours. — By Professor C. J. KEYSER : Plane analytic geometry, five hours ; Modern analytic methods in geometry, five hours. — By Professor EDWARD KASNER : Differential equations, five hours. — By Dr. G. H. LING : Integral calculus, five hours ; Theory of functions of a complex variable, five hours. — By Mr. MAXSON : Analytic geometry, five hours.

UNIVERSITY OF PENNSYLVANIA (summer session, July 8 to August 17). — By Professor E. S. CRAWLEY : Higher analytic geometry, five hours. — By Professor I. J. SCHWATT : Definite integrals, five hours. — By Professor G. H. HALLETT : Theory of functions of a complex variable, five hours. — By Dr. F. H. SAFFORD : Differential equations, five hours.

THE following courses in mathematics will be offered during the year 1907–1908.

YALE UNIVERSITY. — By Professor J. PIERPONT : Introduction to the theory of functions, two hours ; Projective geometry, two hours ; Elasticity and hydromechanics, two hours ; Elliptic functions, two hours. — By Professor P. F. SMITH : Higher geometry, two hours ; Geometric analysis, one hour. — By Professor E. W. BROWN : Mechanics, two hours ; Celestial mechanics, two hours. — By Professor H. E. HAWKES : Algebra and analytic geometry, two hours ; Teachers' course in geometry, two hours ; Advanced algebra, two hours. — By Professor M. MASON : Differential equations, two hours ; Integral equations, one hour ; conformal mapping and Riemann surfaces, one hour. — By Professor E. B. WILSON : Molecular properties of matter, two hours ; Gravitation and electrostatics, one hour. — By Dr. W. A. GRANVILLE ; Differential geometry, two hours. — By Dr. L. I. HEWES : Differential equations, one hour ; geometric transformations of the plane and of space, two hours ; Graphical and numerical computation, one hour. — By Dr. W. R. LONGLEY ; Differential geometry, two hours. The mathematical club meets fortnightly.

THE following courses in mathematics are announced by the various foreign universities for the summer semester :

UNIVERSITY OF BERLIN. — By Professor H. A. SCHWARZ: Integral calculus, with exercises, four hours ; Theory of elliptic functions and selected chapters of the theory of functions, four hours; Seminar, two hours ; Colloquium, two hours. — By Professor G. FROBENIUS : Theory of algebraic equations, four hours ; Seminar, two hours. — By Professor F. SCHOTTKY : Theory of potential, four hours ; Special theory of functions, two hours ; Seminar, two hours. — By Professor G. HETTNER : Fourier series and integrals, four hours. — By Professor J. KNOBLAUCH : The influence of Euler's work on modern mathematics, two hours ; Theory of surfaces, II, four hours ; Theory of space curves, two hours. — By Professor R. LEHMANN FILHÈS : Differential calculus with exercises, four hours. — By Professor E. LANDAU : Calculus of variations, four hours ; Theory of probabilities, two hours. — By Dr. I. SCHUR: Theory of determinants, four hours.

UNIVERSITY OF BONN. — By Professor E. STUDY : Differential geometry, four hours ; Selected chapters in mechanics, two hours ; Seminar, two hours. — By Professor G. KOWALEWSKI: The division of the circle, four hours ; General theory of differential equations, four hours. — By Professor F. LONDON : Elements of differential and integral calculus, four hours ; with exercises, two hours ; Axonometry and perspective, two hours. — By Dr. E. SCHMIDT : Definite integrals, four hours; Foundations of point sets and the theory of real functions, two hours.

UNIVERSITY OF GÖTTINGEN. — By Professor F. KLEIN : Curves and surfaces, four hours ; Seminar, two hours. — By Professor D. HILBERT : Theory of differential equations of one variable, four hours; Seminar, two hours. — By Professor H. MINKOWSKI : Calculus of variations, four hours; Radiation, two hours ; Seminar, two hours. — By Professor C. RUNGE: Numerical solution of equations, with exercises, four hours ; Photogrammetry, with exercises, two hours; Seminar, two hours. — By Professor L. BRENDEL : Insurance, four hours ; Seminar, two hours. — By Professor L. PRANDTL : Introduction to thermodynamics, four hours ; Theory of machines, two hours ; Seminar, two hours. — By Dr. F. HERGLOTZ : Linear differential equations of complex variables, four hours. — By Dr. C. CAR-

A THÉODORY : Differential and integral calculus, four hours. —
By ——————— : Analytic geometry, four hours. — By Dr.
M. ABRAHAM : Hydrodynamics, four hours.

UNIVERSITY OF LEIPZIG : By Professor C. NEUMANN :
Selected chapters of mathematics, four hours. — By Professor
A. MAYER : Analytic dynamics, with exercises, four hours. —
By Professor O. HÖLDER : Theory of functions of a complex
variable, four hours ; Definite integrals, four hours ; Seminar,
two hours. — By Professor K. ROHN : Projective geometry, four
hours ; Plane analytic geometry, four hours · Seminar, two hours.
— By Professor A. VON OETTINGEN : Geometric drawing, four
hours.— By Professor F. HAUSDORFF : Algebraic equations, four
hours. — By Professor H. LIEBMANN : Ordinary differential
equations, with exercises, four hours.

UNIVERSITY OF OXFORD (*Easter and Trinity terms*). — By
Professor W. ESSON : Comparison of analytic and synthetic
methods in the theory of conics, two hours ; Informal instruc-
tion in geometry, one hour. — By Professor E. B. ELLIOTT :
Theory of functions, three hours. — By Professor A. E. H.
LOVE : Waves and sound, three hours. — By Mr. A. L. DIXON :
Calculus of variations, one hour. — By Mr. H. T. GERRANS :
Line geometry, two hours. — By Mr. A. E. JOLLIFFE : In-
variants and covariants of conics, one hour. — By Mr. P. J.
KIRKBY : Higher plane curves, three hours. — By Mr. J. W.
RUSSELL : Rigid dynamics, two hours. — By Mr. E. H.
HAYES : Electrostatics, one hour. — By Mr. R. F. McNEILE :
Algebra, two hours. — By Mr. C. E. HASELFOOT : Series and
continued fractions, two hours. — By Mr. A. L. PEDDER :
Spherical trigonometry, one hour. — By Mr. C. H. SAMPSON :
Solid geometry, two hours. — By Mr. C. H. THOMPSON : Dif-
ferential equations, two hours.

UNIVERSITY OF PARIS (March 1 to June 15). — By Pro-
fessor E. PICARD : Integrals of partial differential equations,
two hours. — By Professor E. GOURSAT : Differential equa-
tions, one hour. — By Professor L. RAFFY : Theory of curva-
ture of lines traced on surfaces, one hour ; Conference, two
hours. — By Professor P. PAINLEVÉ : Kinematics, two hours.
— By Professor P. APPELL : Analytic mechanics, three hours.
By Professor E. BOREL : Calculus of probabilities, one hour.—
(In the Ecole Normale) — By Professor J. TANNERY : Differ-

ential and integral calculus, two hours. — By Professor L.
RAFFY : Applications of analysis to geometry, two hours. —
By Professor E. BOREL, and by Professor J. HADAMARD :
Courses in general mathematics, two hours.

UNIVERSITY OF STRASSBURG. — By Professor T. REYE:
Selected chapters of higher synthetic geometry, four hours ;
Theory of potential, two hours ; Seminar, two hours. — By
Professor H. WEBER : Definite integrals and introduction to
the theory of functions, four hours ; Algebra, four hours ;
Seminar, two hours. — By Professor M. SIMON : Teaching of
mathematics in schools, four hours. — By Professor J. WELL-
STEIN : Introduction to the theory of algebraic functions, four
hours ; Riemann surfaces, two hours ; Seminar, two hours. —
By Professor H. E. TIMERDING : Analytic geometry of space,
four hours ; Descriptive geometry, II, with exercises, four
hours ; Development of mechanical principles, two hours ;
Seminar, two hours. — By Dr. P. EPSTEIN : Analytic theory
of numbers, four hours.

THE University of Glasgow has conferred the honorary de-
gree of doctor of laws on Professor H. POINCARÉ, of the Uni-
versity of Paris, and on Professor U. DINI, of the University
of Pisa.

AT the University of Chicago Professor H. MASCHKE has
been promoted to a full professorship of mathematics, and
Professor L. E. DICKSON to an associate professorship of
mathematics.

PROFESSOR E. B. WILSON, of Yale University, has been
appointed to an associate professorship of mathematics at the
Massachusetts Institute of Technology.

AT Haverford College, Professor L. W. REID has been pro-
moted to a full professorship of mathematics.

PROFESSOR J. B. WEBB, of the Stevens Institute of Tech-
nology, will retire from the active duties of his professorship at
the close of the present academic year.

MR. E. A. MORITZ has resigned his instructorship at the
University of Wisconsin to accept a business position in electric
engineering.

THE deaths are announced of Professor A. SUCHARDA, of the technical school at Brünn, on February 20, at the age of 52 years ; Dr. J. LYON, of the University of Geneva, on January 26, at the age of 49 years ; Professor G. G. TSWETKOFF, of the Moscow school of forestry.