88). Some may take this to mean that "the conduct of life" may still be considered (*e. g.*, ethically or "philosophically") apart from science, and, conversely, that science may still have an aspect (*e. g.*, the pursuit of truth) that is independent of the conduct of life.

The author's captivating style is too well known to call for comment. The publishers have given the book a very attractive form.

A. W. MOORE

Allen's Commercial Organic Analysis. Volume IV., Resins, India-rubber, Gutta-percha and Essential Oils. Philadelphia, P. Blakiston's Son and Co. Pp. viii + 466. $5.00 net.

The subjects covered in this volume are: Resins, by M. Bennett Blackler; India-rubber, Rubber Substitutes and Gutta-Percha, by E. W. Lewis; Hydrocarbons of Essential Oils, by T. Martin Lowry; Ketones of Essential Oils, by T. Martin Lowry; Volatile or Essential Oils, by Ernest C. Parry; Special Characters of Essential Oils, by Henry Leffmann and Charles H. LaWall.

As with the previous volumes of the series, the book contains a very large amount of detailed information which is very valuable for any one who has occasion to work with the great number of organic compounds which are used in industry. The preparation of the successive chapters by chemists who have expert knowledge of the subjects of which they write insures accuracy and a wealth of information which it would be impossible to secure in any other way.

W. A. NOYES

SCIENTIFIC JOURNALS AND ARTICLES

THE April number (volume 12, number 2) of the *Transactions of the American Mathematical Society* contains the following papers:

Anna J. Pell: "Biorthogonal systems of functions."

Anna J. Pell: "Applications of biorthogonal systems of functions to the theory of integral equations."

C. N. Moore: "On the uniform convergence of the developments in Bessel functions."

H. H. Mitchell: "Determination of the ordinary and modular ternary linear groups."

G. D. Birkhoff: "General theory of linear difference equations."

THE April number (volume 17, number 7) of the *Bulletin of the American Mathematical Society* contains: "Groups generated by two operators satisfying two conditions," by G. A. Miller; "Fundamental regions for cyclical groups of linear fractional transformations on two complex variables," by J. W. Young; "On the relative discriminant of a certain Kummer field," by Jacob Westlund; "Note on reciprocal figures in space," by Peter Field; "Mathematical physics for engineers," review of Gans' Einführung in die Theorie des Magnetismus, Schaefer's Einführung in die Maxwellsche Theorie, and Jahnke and Emde's Funktionentafeln und Curven, by E. B. Wilson; "Shorter Notices": Huntington's Fundamental Laws of Addition and Multiplication in Elementary Algebra, by N. J. Lennes; Borel's Théorie de la Croissance, by R. D. Carmichael; Tannery's Elemente der Mathematik, by J. B. Shaw; Weitzenböck's Komplex-Symbolik, by C. L. E. Moore; Staude's Analytische Geometrie des Punktepaares, des Kegelschnittes und der Fläche zweiter Ordnung, by D. D. Leib; Festschrift zur Feier des 100 Geburtstages Edouard Kummers, by L. E. Dickson; Thiele's Interpolationsrechnung, by H. L. Rietz; Slaught and Lennes's Plane Geometry, by F. W. Owens; Breckenridge, Mersereau and Moore's Shop Problems in Mathematics and Lester's Integrals of Mechanics, by C. F. Craig; Annuaire du Bureau des Longitudes, by E. W. Brown; De Montessus' Leçons élémentaires sur le Calcul des Probabilités, by E. B. Wilson; "Notes"; "New Publications."

The May number of the *Bulletin* contains: Report of the February meeting of the society, by F. N. Cole; "On the classification of crystals," by Paul Saurel; "Horner's method of approximation anticipated by Ruffini," by Florian Cajori; Review of the New Haven Colloquium Lectures, by G. D. Birkhoff; "Shorter Notices": Bauer's Vorlesungen

über Algebra, by Arnold Dresden; Richard and Petit's Théorie mathématique des Assurances, by E. B. Wilson; "Notes"; "New Publications."

THE QUIZ DEMONSTRATION SYSTEM OF TEACHING QUALITATIVE ANALYSIS

It is time that we are awakening to the fact, that in the line of elementary laboratory work there is altogether too much poor impartation of knowledge. This is particularly the case as regards general chemistry and qualitative analysis, especially when considered from the standpoint of those who expect to carry on their life work in the field of engineering and industrial chemistry.

Qualitative analysis is especially subject to error. Who would think of trusting to a civil engineer, ignorant of the strength of the material employed, the construction of a bridge? Or one's child to a doctor, if cognizant of the fact that he did not know the properties of the drug he was administering? Is it not of as great import to a chemist that he understand the properties of the chemical elements, the material he is using in his daily work?

This being true, why is it that the laboratory instruction is, in many cases, left to assistants paid the munificent sum of from $200 to $500 per year, with, consequently, very indifferent instruction? If they are the best the institution can afford, the fault can be remedied, in part, by the man in charge giving to his assistants all the instruction within his power.

Detail laboratory instruction is the hardest of work, if rightly given, as difficult as any quiz or demonstration, for what is it, if properly conducted, but one continual individual quiz and demonstration of from two to three hours' duration? It is common to consider from two to three laboratory hours as equivalent to one lecture or quiz hour. This is a mistake, at least as far as the instructor is concerned, for it is not a greater impossibility for a man to lecture or quiz for half a day at a time, day in and day out, than for him to give the best that is in him to a laboratory class extending over a like period. I hear some one reply that it takes more time to prepare for a lecture or quiz than for a laboratory period. Granted, when the laboratory work is conducted as is most customary. But when the instructor keeps abreast of the times, makes a thorough test of the new methods, keeps track of and endeavors to overcome the difficulties of the ordinary class in qualitative analysis, he will devote much more time to the preparation of his work than a language teacher, for instance, who, year after year, employs the same text in class work. You see I am not making the statement, "He does this," but that he should. This is, of course, not possible when the hours of labor are too many to allow for it the requisite time. They should be shortened. There should be a certain amount of time spent by the instructor in his laboratory "doing things." A German teacher must know how to read the language. To teach laboratory work correctly a man must be able to do the work well himself.

Inasmuch as I am desirous of suggestions and criticisms from my fellow instructors, an underlying, selfish motive prompts me to present the scheme for laboratory instruction employed by me. It is one which I have successfully made use of during the past three years and I feel it a step in advance of the methods heretofore used by me, and of those which I have seen employed elsewhere.

Chemical theory is based on facts obtained in the laboratory. It is then true, that for a thorough comprehension of the theory it is necessary that the student be conversant with the facts before he can understand the application. I proceed, therefore, with this in view, as my main objective point.

As an essential, the instructor must see every test made by the student. That this may be accomplished the too often "drifting" about the laboratory by the instructor must be done away with. There must be system. There must be known, to some one in charge, what is going on in every part of the laboratory. Yet in this system, two things must be guarded against in the student. First, lack of independence. Second, useless waste of time,