

of each coefficient—that is to say, its order in the eccentricities, inclination, and solar parallax—can be written down by inspection, and is not modified by any integration or other process that occurs in the computations. The order, however, in the ratio of the mean motions does not follow any simple law. This is due to the fact that certain terms rise in importance on integration. The class of terms that behave thus is carefully pointed out in the book, and the fact that their consequent increase in importance is transmitted to the terms in *queue* with them, thereby doubling the number of approximations necessary, is noticed. As far as we know, the whole question has never been thoroughly gone into, so as to form rules whereby the order in the mean motions of every term may be estimated. It would form a fitting subject for a thorough investigation. For instance, with Delaunay's notation, the term with argument $2D$ is of order m^2 , the term with argument $2D - l$ has been lowered by one order in m to me . The term in $4D + l$ may be considered as made up of $2D + 2D + l$, $2D + (2D - l) + 2l$, or $(2D - l) + (2D - l) + 3l$, and its order will be m^4e , m^3e^3 , m^2e^5 in the three cases. Similarly the order of the term in $4D - l$ is m^3e and m^2e^3 . These are simple cases illustrating the fact that lower powers of m often occur than the power by which the characteristic part of the coefficient is multiplied.

The treatise deals with four theories in some detail—De Pontécoulant's, Hansen's, Delaunay's and Hill's. De Pontécoulant's is an easy one to understand, and the author has attached to it his discussions of the constants and other points that are in reality common to all theories in variously modified forms.

Hansen's theory is an extremely difficult one, and Tisserand has entirely failed to give an intelligible account of it. Prof. Brown, too, leaves something to be desired; but we at least owe to him a remarkable simplification in an introductory lemma (recently published in the *Monthly Notices*). The proof given by Prof. Brown is so simple, that its merit is only apparent to those who have read Hansen's investigation of the same point. Hansen's theory is of a curious design: the inequalities are thrown upon the time or the mean longitude. Dr. Hill considers that the method was an outcome of an extension to all terms of a method used by Laplace for terms of long period.

Delaunay's theory is a gigantic task representing twenty years' labour. His method is the variation of arbitrary constants, using canonical equations. Prof. Brown has considerably simplified the introductory analysis on which the theory rests, and has recently published a further simplification in the *Proceedings* of the London Mathematical Society.

Dr. Hill's theory is the most recent, and the simplest in form. It is, however, as yet far from complete. It was, as is well known, originated by some papers of Dr. Hill's in the first volume of the *American Journal* and the eighth volume of the *Acta Mathematica*. In these papers Dr. Hill obtains the variation curve (that does duty as the intermediate orbit) and the motion of the perigee. The further development has been left almost entirely to Prof. Brown, who has published a series of papers in the *American Journal*. Among these is a paper of great analytical interest containing some

theorems that include two famous theorems of Adams' as a special case. It is much to be wished that Dr. Hill's theory should be completed.

The book concludes with a short sketch of several other theories, and the methods used in computing inequalities other than those due to the sun.

OUR BOOK SHELF.

Chemistry for Engineers and Manufacturers. A Practical Text-book. By B. Blount and A. G. Bloxam. Vol. ii. *Chemistry of Manufacturing Processes.* Pp. 484. (London: C. Griffin and Co., Ltd., 1896.)

It is stated in the preface that the sole object of this work is to give the reader a general view of the principles which underlie the several manufactures described. The ground covered is very wide, so that in order to keep the book within reasonable limits a very condensed style has been adopted. The opening chapters deal with the manufacture of sulphuric acid and alkali, and the destructive distillation of coal, wood, and bone, the account of coal-gas manufacture being especially well done, although the short account of methods of gas-testing is sketchy and inadequate, and might have been omitted with advantage. The subjects of artificial manures, petroleum, cement, glass and porcelain, sugar and starch, brewing and distilling, oils, resins and varnishes, are next dealt with. The soap and candle industry is dismissed in nine pages, no account being given of the chemistry of the "cold process" of soap-making, in which the excess of alkali is eliminated by the subsequent addition of ammonium salts, although most of the highest grades of toilet soaps are now prepared by this process. The chapter on dye-stuffs, which follows, contains a good synopsis of the chemistry of this subject. It is, however, too brief to be of much service to the dye-works chemist, and is certainly beyond the apprehension of the average engineer.

The authors, indeed, are rather optimistic in their estimate of the chemical knowledge possessed by engineers, as chemical formulae and equations are freely used throughout the book. Of the remaining chapters, those dealing with the preparation of pigments, leather, and explosives are the most important. In view of the growing importance of cyanide compounds in gold extraction, it is to be hoped that a little more space will be found for this subject in the next edition, no mention being made of the recent advances in the industrial applications of the well-known synthesis from alkalis, carbon, and gaseous nitrogen. The short bibliography at the end of the book will prove useful in following up the details of any particular subject.

The Struggle of the Nations. By G. Maspero. Edited by A. H. Sayce, and translated by M. L. McClure. (Society for Promoting Christian Knowledge, 1896.)

SOME time ago (see NATURE, No. 1310) we called the attention of our readers to the issue of a much enlarged and illustrated edition of M. Maspero's work "Histoire Ancienne des Peuples de l'Orient Classique" in a notice of the first volume, which appeared in England under the title of "The Dawn of Civilization," and we welcomed it as a book much to be desired. The second volume now before us is the next instalment of the edition, and we welcome it no less gladly; it is to be hoped that the intervals between the issue of the volumes will become shorter and shorter, and that the whole work may be in our hands in a few years. The period covered by the first volume extended from the time when we first have written records in Egypt and Western Asia (including Babylonia) to the end of the reign of the kings of the twelfth dynasty in Egypt, say about B.C. 2500; in this volume we are led from the time of Khammurabi and his immediate predecessors to the end of the twenty-first