a series; and doubtless the book, which is a novel one, will prove useful alike to professors, assistants, and students. Its primary purpose is that of a laboratory guide.

Four Figure Mathematical Tables. By J. T. BOTTOMLEY. London, Macmillan. 12°.

THIS is a series of mathematical tables comprising logarithmic and trigonometrical tables, and tables of squares, square roots, and reciprocals. In an appendix are contained a number of useful formulas and numbers, especially for those engaged in work in physical laboratories. The book is compiled by a lecturer in natural philosophy in the University of Glasgow.

NOTES AND NEWS.

IN order to expedite the publication of short articles upon astronomical and meteorological subjects which may be prepared at Harvard College Observatory, it has been decided to print them as successive numbers of a series, which will constitute the eighteenth volume of the 'Annals of the Observatory' when a sufficient amount of material has thus been collected. Each number will be published and distributed soon after it has been prepared.

— During this month will appear, under the editorship of Dr. G. H. Rohé, a quarterly journal, *The Climatologist*, devoted to the consideration of questions in the domain of medical and sanitary climatology. As there is at present no other journal in the world exclusively occupying this special field, the editor and publishers believe that there is room for such a publication. Each number will contain forty-eight quarto pages of reading-matter, the subscription price will be fifty cents per year, and the place of publication, S. E. Cor. Baltimore and South Streets, Baltimore, Md.

— Dr. John Vansant of the United States Marine Hospital at St. Louis claims to be the first to have taken photographs by the light of fireflies. He placed twelve fireflies in a three-ounce bottle, covering its mouth with fine white bobinet. The average duration of the flash of each insect was half a second, and the luminous area on the abdomen was about one-eighth of an inch square. The time of exposure was fifty flashes.

— Lieut. J. F. Moser, U.S.N., commanding the Coast Survey steamer 'Bache,' has just submitted a report of the hydrographic work executed by that steamer from Cedar Keys southward to a point off Chasahowitzka River, and the finishing of the hydrography from Cape Romano to the delta of the Mississippi. He refers to the great difficulty of running triangulations, owing mainly to the obscurity or entire absence of former triangulations, or other ear-marks of the locality to be surveyed. St. Martin's Reef was found to continue as far north as Homosassa, thence trending eastward to join the shallow waters of Crystal River. It is on the Florida banks, of which St. Martin's Reef forms an inshore part, that many of the commercial sponges are taken, and a large number of vessels are yearly engaged on the work. The tides in this locality were found to be easily affected by winds, causing great irregularity in their range, stand, and times of movement. The coast was found to be low and rocky, and the entire bottom covered with porous rock. The anchorage off St. Martin's Reef is good and safe in any weather except a hurricane. Lieutenant Moser says the country is dreary, desolate, and uninhabited, and the coast-line consists of fringing islands, thickly covered with mangrove. On these islands oysters are found growing in trees, the spawn having attached themselves to the branches at high water and developed into oysters. Bird-life was not abundant, even sea-gulls being conspicuous by their absence. Rail and blue and white herons were found, but even these birds have been driven away by the plume-hunters.

— A. Auwers has thoroughly discussed the alleged periodical changes of the diameter of the sun, and finds that in fact they do not exist. His researches, which are founded on 19 series of observations, — 12 of which refer to the horizontal diameter, and comprise 21,000 observations, while 7 refer to the vertical diameter, — show that the periodical changes are due to the influence of the temperature upon the instruments with which the observations were made, and that for this reason the period corresponds to that of the annual period of temperature.

LETTERS TO THE EDITOR.

Experimental Physics for Schools.

FOR years one of the requirements for admission to Harvard College has been such knowledge of physics as may be obtained from the study of any one of certain well-known elementary text-books. To this requirement is now added the study of a certain astronomical text-book, but as an alternative to both the text-book physics and the astronomy there is recommended a course of study in physics involving considerable laboratory work on the part of the pupil, supplemented by instructions from a text-book or a course of lectures.

Two questions suggest themselves to the teacher of physics when he finds himself met by the proposition to give laboratory practice to a whole class: 1st. Is this desirable if practicable? 2d. Is it practicable?

Without undertaking to discuss at large the theory of a liberal education, we can note a few considerations which will enable us to answer the first of these questions with some confidence: 1st. Physics is studied partly for training and partly for information. 2d. Text-book physics alone gives but little training that cannot be given by arithmetic, algebra, and geometry, all of which studies are pursued by the pupil before he enters college. 3d. Physics as taught by the laboratory experience of the pupil gives a kind of training that is not given by any course of study *required* for admission to Harvard College or, perhaps, any other college in the country. This training is partly of the senses and partly mental. It is true that many book-studies educate the senses to a certain extent, and the logical faculties, but unfortunately it is possible for a person who is observing and logical in things which he is in the habit of studying to be quite the opposite in dealing with things which do not habitually occupy his mind. Now, laboratory physics is the only elementary study for admission to Harvard College that requires the student to look beyond the pages of a book, and although most students do look at other things than books, they are not in the habit of *studying* things outside of books. 4th. The information given by the text-book alone is wide but superficial and vague. It is like that knowledge of a country which one may get by travelling rapidly over it on a railroad train. 5th. The information given by laboratory practice alone is definite but narrow. It is like that knowledge of a country which one would get if he tried to go over the whole of it on foot. 6th. Most students show far more interest in laboratory work than in the study of a text-book, even when the same subjects are dealt with in both cases. Much of the repugnance which many students feel for physics as they study it comes from the almost painful effort of the imagination to body forth the things described in the text-books, and which might be seen directly and handled in the laboratory.

From these considerations we reach the conclusion that the course which Harvard recommends to preparatory schools is desirable, if practicable, viz., to have the pupil study intimately certain topics by the laboratory method, and to enlarge upon, apply, and connect the knowledge so gained, by means of a text-book or a course of lectures. In the opinion of the writer, a course of lectures sufficiently extensive and systematic to take the place of a text-book for this purpose is beyond the present powers of most preparatory schools.

It may be hoped that by following such a course in physics the student will escape, on the one hand, a condition of blind and helpless dependence upon text-books, and, upon the other hand, the scarcely less unfortunate state of self-sufficiency which cannot or will not profit by the literature of the science.

Harvard University has issued for the use of teachers engaged in preparing students for its college classes a pamphlet giving a list of forty laboratory exercises, with specifications of the apparatus and materials to be used in these exercises, and with directions for their performance, or references to manuals giving such directions. These exercises are to be performed by the pupil. To speak cursorily, they deal with certain distinctive characteristics of the solid, liquid, and gaseous states of matter, the determination of specific gravities, the first principles of statics and dynamics, evaporation and boiling, the determination of the fixed points of a thermometer, expansion of solids and gases, specific heat, latent heat, velocity of sound, interference of