

emigrants. But Mr. Oakenfull goes beyond his brief when he dwells on the superiority of Brazil to the British Colonies, particularly in relation to the price of land. It must be remembered that Brazil is as yet only partially developed, and the present economic situation may be gauged by the value of the national securities. While Canada 3 per cents. are now quoted at 83, Brazil 4 per cents. of 1910 stand at 49. No doubt this is owing to temporary causes, but for the intending emigrant the contrast is significant.

Improved Four-Figure Logarithm Table, Multiplication and Division Made Easy. By G. C. McLaren. Pp. 27. (Cambridge: At the University Press, 1915.) Price 1s. 6d. net.

THESE tables aim at popularising logarithms. Like other four-figure tables they give the logarithms of numbers from 1000 to 9999. While the ordinary tables give these in one opening of two pages by means of difference columns, Mr. McLaren gives all the 9000 entries independently, and so of course without difference columns. His tables consequently occupy nine openings or eighteen pages. Rapid reference to the various openings is made possible by "thumb-indexing," and for speed there is probably nothing to choose between these tables and the customary ones. There is a gain in accuracy, both because the use of difference columns is not trustworthy in the last figure, and because of Mr. McLaren's ingenious device of showing the last figure to the nearest third. Whether these tables seriously reduce the skill required for their use as compared with the customary tables we have some doubt. We think their appeal will be chiefly to those calculators who require slightly greater accuracy than the customary tables allow and who at present use five-figure tables. D. M.

Joseph Pennell's Pictures in the Land of Temples. 40 illustrations. (London: William Heinemann, 1915.) Price 5s. net.

THE sub-title to this attractive volume very well describes its contents. It runs: "Reproductions of a series of lithographs made by him in the land of temples, March-June, 1913, together with impressions and notes by the artist." The illustrations start at Taormina, proceed around Sicily—thence to Italy, and are continued in Greece. The book is dedicated to Mr. R. M. Dawkins, late director of the British School at Athens, who showed Mr. Pennell where he would find the temples. The artist says with becoming modesty that having seen the pictures Mr. Dawkins expressed the opinion that they had "something of the character and romance of the country." It is unnecessary here to praise the work of so distinguished an artist; it is enough to say that the pictures convey just the impression which the temples made upon Mr. Pennell: "the great feeling of the Greeks for site in placing their temples and shrines in the landscape—so that they not only became a part of it, but it leads up to them."

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LETTERS TO THE EDITOR.

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The Continuous Spectra of Gases.

IN spectroscopic literature there are many casual references to a continuous background in the vacuum tube spectra of various gases, such as oxygen, chlorine, etc. Usually these observations appear to have been confined to the visible region, and I can recall no comments on continuous spectra in the ultra-violet except in the case of hydrogen. Schniederjost (*Zt. f. Wiss. Phot.*, 1904, p. 265) and Friederichs (*Bonn Diss.*, 1905) observed such a spectrum at low pressures, which extended to a wave-length of about 2100. The latter attempted to use the uncondensed discharge through a small capillary tube at about 2 mm. pressure as a source for the photography of absorption spectra, but found that the results were unsatisfactory, even with exposures varying from twelve to twenty-four hours.

In photographs of the hydrogen spectrum obtained with a large two-prism quartz spectrograph I have frequently observed this continuous spectrum. Although the resolving power of this spectrograph in the extreme ultra-violet is greater than that of a five-inch grating in the first order, there is no evidence of resolution into lines or bands. The spectrum appears to be uniformly continuous, and it seems likely that its gradual fading out in approaching the wave-length 2100 is due rather to the absorption of the thick quartz system than to the lack of these wave-lengths in the emitted light. It appears to be due to pure hydrogen, for successive improvements in purity due to the removal of oxygen, water vapour, and nitrogen cause no noticeable change; nor does the addition of a trace of oxygen to hydrogen previously freed from that gas so far as possible cause any appreciable difference.

It seems very unlikely that a continuous spectrum can arise from free vibrations within the atom or molecule, hence it has been usually ascribed to molecular collisions. In comparing different gases at the same pressure, the number of collisions would depend mostly on the mean velocity of the molecules, so that the number of collisions would rapidly diminish as the molecular weight increases; hence we might expect that the continuous spectrum of a light gas would be stronger than that of a heavier gas. This was found to hold good for hydrogen, helium, and neon. Photographs were obtained of the spectra of these three gases in vacuum tubes prepared by Hilger. The pressure was about the same in all. With a two-minute exposure, the continuous spectrum of hydrogen was very intense, that of helium about half as strong, and that of neon about one-third as strong. They all extended to about the same limit—that set by the transparency of the quartz. In all these cases the uncondensed discharge of a medium-sized induction coil was used. The introduction of a condenser almost completely obliterated the continuous spectrum. When a condenser is used the radiation probably comes from dissociated ions, with free periods little disturbed by molecular collisions.

Nitrogen, krypton, and xenon did not show any continuous spectrum.

Some tests showed that hydrogen tubes may render excellent service as sources for the study of absorption spectra in the ultra-violet. It was not found advisable to use capillary tubes, or to work at such low pressures as Friederichs did. The best results were