THE LIME TREE AND ITS PRODUCTS.[1]

ONE of the most promising of the newer industries of the West Indies is the cultivation of limes. Lime products, at the present time, form the principal exports from the island of Dominica, and are second only to cotton in the island of Montserrat. Large tracts of land have recently been taken up in British Guiana for the cultivation of lime trees, and progress is being made at St. Lucia, Carriacou, and elsewhere.

Lime fruits in a fresh condition are now largely exported from Dominica to New York, London, and Manchester. They can be used for every purpose to which the lemon is put, and are considered more economical. Raw lime-juice is exported for making cordials, and the concentrated juice forms one of the principal sources of commercial citric acid. The essential oil, both hand-pressed and distilled, is of value in perfumery.

The tree appears to be confined to tropical and subtropical zones, and has not nearly so extensive a range of growth as the orange or lemon. In these circumstances the West Indian Department of Agriculture is well advised to issue clear and popular instructions for planting and cultivating the tree, and for dealing with the various products. The Department has, indeed, gone further, and has distributed many thousands of lime plants; in consequence, the value of the exports last year from Dominica was more than 77,000*l*. Of the two varieties, the ordinary spiny and the spineless, the juice from the latter appears to be the purer and richer in acid.

"The A.B.C. of Lime Cultivation" is drawn up by Mr. Joseph Jones, curator of the Botanic Station at Dominica, and Mr. J. C. Macintyre, a large grower. It gives a concise but eminently readable account of the crop, and merits more than a local circulation.

Dr. Watts deals in the West Indian Bulletin with the question of citric acid. It appears that manufacturing chemists prefer buying calcium citrate rather than the concentrated lime-juice, and Dr. Watts describes methods of preparing the salt. Chalk is added in proper quantity to the juice, and the precipitated citric acid is allowed to settle, is then washed with hot water and dried. At present drying constitutes a great difficulty; the experiments show that a centrifugal machine works well, but the best type still remains to be determined, and many other details of the manufacture have also to be worked out.

The whole industry appears to be a very promising addition to the resources of the West Indies, and the Department of Agriculture is to be congratulated on the vigorous action it is taking.

MATHEMATICS AND PHYSICS AT THE BRITISH ASSOCIATION.

THE president of Section A (Mathematical and Physical Science) delivered his address on Thursday, September 3. This address has already appeared in full in NATURE of September 3 (p. 425). It was followed by an important discussion on the isothermal layer of the atmosphere. Of this, also, a detailed account has already been given in NATURE (October 1, p. 550).

Prof. W. F. Barrett (who was one of the vice-presidents of the section) concluded the morning's proceedings with an account of an ingenious combined optometer and entoptiscope. On meeting again after lunch various reports of committees were taken. The committee on improving the construction of practical standards for electrical measurements directed special attention to the conclusion of the electrical measurements of certain of the fundamental units which have been in progress for some time at the National Physical Laboratory. The E.M.F. of the Weston cadmium cell as set up in the laboratory is given as $1{\cdot}0183_0$ at 17° C. Six forms of silver voltameter give (with proper precautions) the value 1·11827 milligrams for the silver deposited by 1 ampere per second. There are two important appendices to the report:—(1) on the secular changes of the standards of resistance at the National Physical Laboratory, by F. E. Smith; and (2) specifications for the practical realisation of the definitions of the international ohm and international ampere, and instructions for the preparation of the Weston cadmium cell. The other reports read were those rendered by the committees on kites, geodetic arc in South Africa, meteorological observations on Ben Nevis, and magnetic observations at Falmouth Observatory.

The large number of papers down for reading in this section made necessary a separation on three of the days into three departments, which sat concurrently. This trifurcation began on Friday, September 4. The mathematical department began with the reading of the report of the committee on the further tabulation of Bessel functions. Dr. T. W. Nicholson then communicated some formulæ useful for the computation of Bessel functions when the order and the argument are both large. Dr. E. W. Hobson followed with a paper on Sir W. Hamilton's fluctuating functions. In this paper Dr. Hobson reviewed and criticised Hamilton's work, and he specially directed attention to the extraordinarily sure instinct with which Hamilton anticipated many of the results of the modern theory of the definite integral, and steered clear of the many pitfalls which surround this particular subject, in spite of the imperfect and often erroneous ideas on this matter which were current at the time among mathematicians. Prof. Lamb, in the discussion which followed, referred to this point, and remarked that the inaccuracy of the methods of the older analysts was often more apparent than real, because they took for granted much of which they were aware, but which it is now the fashion to write down explicitly.

Dr. S. H. Burbury then read a paper on the law of equipartition of energy, in which he showed that this law was really independent of the Boltzmann-Maxwell assumption that the variables were uncorrelated. Prof. J. C. Fields gave an account of a new proof of a theorem recently discovered by himself, to which he has given the name of the complementary theorem. The full statement of the theorem, which deals with properties of algebraic functions of a complex variable, is somewhat long, but the theorem is of a most general character, and includes a large number of important results previously known. Mr. Robert Russell explained a new method of introducing the elliptic functions. Denoting the expression

$$a_0x^4+4a_1x^3+6a_2x^2+4a_3x+a_4$$

by $f(x)$, and by δ one root of $f(x)=0$, he considered the functions

$$u=\int_\delta^x \frac{dx}{\sqrt{f(x)}} \quad v=\int_\delta^y \frac{dy}{\sqrt{f(y)}}$$

He then showed by simple reasoning that the expression

$$\frac{x-y}{(x-\delta)(y-\delta)}$$

was invariant for transformations of the type

$$x=(l\xi+m)/(l'\xi+m')$$

and thence that a function ϕ existed such that

$$\frac{x-y}{(x-\delta)(y-\delta)}=\phi\frac{(u-v)\,\phi\,(u+v)}{[\phi(u)]^2\,[\phi(v)]^2}$$

This function ϕ, then, turns out to be no other than the ordinary σ-function, which, in this method, is therefore fundamental.

Mr. Russell also gave a new proof of Legendre's identity

$$EK'+E'K-KK'=\frac{\pi}{2}$$

Commenting upon the paper, the chairman (Prof. A. E. H. Love) mentioned that he had recently devised a physical proof of Legendre's identity by considering the magnetic potential of a circular current.

[1] "The A.B.C. of Lime Cultivation" (Imperial Dept. of Agriculture for the West Indies, 1908.)
Bulletin of the Department of Agriculture, Jamaica, 1908. Vol. vi. Parts ii. and iii.
West Indian Bulletin. Vol. viii., pp. 167–172.