agencies of wind, ocean currents and birds. About 80 per cent. of the native land plants inhabit the West Indies, or southern Florida, or both. About 8.7 per cent. of the total native flora is endemic, there being 61 species in Bermuda, or its waters, not known to grow naturally anywhere else in the world. These plants are of the greatest interest to naturalists, as they presumably developed in Bermuda from related plants formerly existing but now mostly extinct there. Of the 61 endemic plants, 11 are flowering plants, 4 are ferns and the rest are flowerless species of mosses, lichens, fungi and algæ. The total number of native species known, those that have reached Bermuda independently of human activities, and have perpetuated themselves, including the endemics mentioned above, is as follows: flowering plants 146 species; ferns and fern allies, 19 species; mosses and hepatics, 51 species; lichens, 80 species; algæ 238 species; fungi at least 175 species. This makes a grand total of 709 species. The number of introduced and completely, or partially, naturalized species, those which have reached Bermuda through human activities, is about 303. It might be added in closing this review that all groups of plants are considered in the "Flora of Bermuda." The least satisfactory portions of the whole book are those dealing with the fungi and the diatoms (*Bacillarieæ*). The description of the fungi deals with much irrelevant matter. It would have been much better to have given what is actually known about the Bermuda fungi, than to have brought in a whole lot of interesting facts about the morphology and physiology of this group of plants, which can be found in the ordinary text-books of morphologic botany, but which do not apply especially to the flora of the group of islands under consideration.

JOHN W. HARSHBERGER

SPECIAL ARTICLES

THE RYDBERG UNIVERSAL CONSTANT N_0

IN connection with some work along related lines, the author has noticed that Curtis,[1] in his work on the Balmer series of hydrogen, reduced his measured wave-lengths to vacuo incorrectly. These wave-lengths were measured on the I. A. system, and hence at 15°C., 760 mm. pressure, while Curtis, for the reduction, used Kayser's Table of Corrections,[2] which applies only to the old Rowland system, founded on 20° C., 760 mm. pressure.

The error thus introduced, for any given frequency, is approximately [1] $(n-1)_0\nu$ where n = index of refraction of air at 0°C., and ν is the frequency. For the spectral range of the hydrogen Balmer series, as well as of all the ordinary helium series $(n-1)_0$ varies by only 2 or 3 per cent. of itself. Thus to this approximation the error is proportional to the frequency.

Now the main object of Curtis's work was to test the accuracy of the Balmer formula, and to derive a more accurate value for the one undetermined coefficient (the Rydberg constant N_0) which occurs in this formula. The Balmer formula is

$$\nu = N_0\left(\frac{1}{4} - \frac{1}{m^2}\right),$$

where $m = 3, 4, 5$, etc. Since the error made by Curtis is fortunately a constant per cent. of the frequency (within 3 per cent.), it will not affect the accuracy with which the formula does or does not fit the series. It will change only the value of N_0. Curtis found that he must actually use the formula

$$\nu = N_0\left(\frac{1}{4} - \frac{1}{(m+\mu)^2}\right),$$

where $\mu = 69 \times 10^{-7}$ and $N_0 = 109{,}679.22$.

The error as given above amounts (in terms of N_0) to 0.50 for H_α, 0.513 for H_β, and 0.515 for the remaining lines. The correct value of N_0 is therefore 109,678.705, which agrees very closely with the value (109,678.6) determined by the author[3] by direct conversion from the Rowland system of the best previous measurements. With this value, Curtis's formula will fit equally well for all the hydrogen lines except H_α. For this line the (obs.-calc.) will be $-0.0008\ A$, instead of $+0.0001\ A$ as given by Curtis. Since the error is only in N_0 and is

[1] *Proc. Roy. Soc.*, (*A*), 90, 605, 1914.

[2] Kayser's "Handbuch," Vol. 2, p. 514.

[3] *Astro. Jour.*, 32, 114, 1910.

the same for any series lying in the same spectral range, it will have no bearing on the controversy regarding the universal constancy of the Rydberg constant. For series extending far into the ultra-violet, this change of value may have some effect.

On Bohr's theory of the hydrogen atom, N_0 is a known function of the charge and mass of the electron, and of Planck's constant h. It is therefore important, on theoretical grounds, to know its value as accurately as possible. The author therefore wishes to emphasize that Curtis's own determination of the hydrogen lines, when handled correctly, leads to a value of this constant of 109,678.705, while the best previous determinations, when converted to the I.A. system, yield an almost identical value. It is hoped that future investigators will use 109,678.705 rather than Curtis's published value of 109,679.22.

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MOISTURE RATIO

Much confusion has existed for years in interpreting the results obtained by various investigators on the determination of moisture in soils, rocks, etc. Noyes[1] has lately endeavored to bring about a more uniform method of reporting the moisture content of soils.

According to Bulletin No. 107, Bureau of Chemistry "Official Methods of Analysis," compiled by the association of Official Agricultural Chemists, the results of soil analysis are calculated as per cent. of the soil dried to constant weight in the water oven. It is rather unfortunate that the official method of reporting results has not been uniformly followed.

One of the phrases suggested by Noyes, "Ratio of water to 100 parts of dry soil," suggested to me the term moisture ratio. Such a term as "moisture ratio" on account of its brevity can be considered an advantage when preparing tables, charts, etc.; and if interpreted as defined below will not cause such confusion as the terms which have been used in the past.

The "moisture ratio" would mean the grams of water to 100 parts of the soil dried to constant weight at a temperature of 100–110° C. The terms "oven dry" or "absolutely dry" are being interpreted by some as meaning the drying of samples to 100° C., while others dry at higher temperatures and use the same terms.

The temperature at which samples are dried is seldom given in papers and as it is possible to control most drying ovens within a range of 10° C., the temperature of drying soil samples when using the term "moisture ratio" would be from 100–110° C.

I have lately made some tests on various electric drying ovens and found a wide range of temperature in some while others showed very little range on various shelves in the oven. The temperatures found on the various shelves in three of those tested are given in the table following:

TEMPERATURE RANGE IN VARIOUS ELECTRIC OVENS

Oven Number	Top Shelf	Middle Shelf	Bottom Shelf
1	96° C.	117° C.	147° C.
2	94	99	105
3	100	96	98

Oven No. 1 has the heating unit near the bottom of the oven and by tests made when empty as well as when full to capacity with soil samples showed a range in temperature of 51° C.

Oven No. 2 is similar to No. 1 except that an extra heavy piece of asbestos was placed above the heating unit leaving an air space of about ½ inch. Tests were made as with No. 1 and showed that the wide range of 51° C. was reduced to 11° C.

Oven No. 3 is a different make of oven, operating on a different principle from No. 1 or No. 2, but also had the heating unit near the bottom of the oven. From a large number of tests made under different conditions this oven never showed a range greater than 5° C. and most of the time it was only 1 or 2 degrees.

[1] "Reporting Moisture Results," H. A. Noyes, Science, N S., Vol. XLVII, No. 1212, p. 293.