states is the excitation potential of that state and the radiating potential of all spectral lines which require this as the initial state of the molecule. We shall define the radiating potential of a band system as the excitation potential of the zero vibrational and zero rotational level of the initial state.

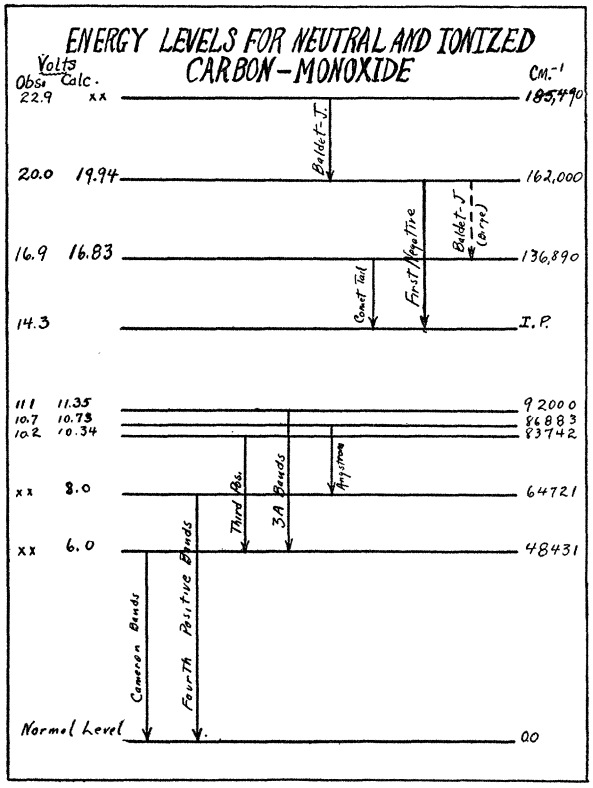

FIG. 1

The radiating potentials of the band systems of the neutral and ionized carbon monoxide molecule, except the Fourth Positive and Cameron bands, were determined by a photographic method, the spectra being excited by electron impacts. The spectra were analyzed on the basis of the quantum theory of band spectra and the relationships between the several systems were determined from these analyses. These relationships have been determined in a similar manner for a part of the bands by Birge[1] and for another part by Johnson.[2] After these relationships have been determined, it is possible to calculate the radiating potentials of the systems. The accompanying diagram indicates these relationships and gives the observed and the computed values of the radiating potentials of the several systems. It will be noticed that the observed radiating potentials confirm the system relationships deduced from the analyses in all cases except that of the Baldet-Johnson system. This system contains so few bands that its relation to others can not be determined with certainty by analysis.

From the results of our investigation it seems that several bands usually included in the Ångstrom system were due to impurities in the gas employed by the original investigators. They fail to appear on any of our spectrograms and, furthermore, do not fit into the term scheme of this system. On the other hand, two bands not previously reported with edges at λ3680.5 and 3894.3 seem to belong to this system. Further work is in progress on the measurement and analysis of the Ångstrom bands.

In a letter to *Nature* (Vol. 118, 12, 1926), the writers described an experiment which demonstrated that the Third Positive carbon bands belong to CO and really comprise two systems which we called the Third Positive and 3A systems. During the course of that experiment new bands were discovered in the spectrum of the flowing gas. They extend from about λ3000 to 5000A. It was concluded from their manner of excitation that they belong to CO_2. An investigation of these bands is now in progress in this laboratory. It was found that some of the strongest of these bands appear in the spectrum of the low voltage arc in CO in the region of the Ångstrom system. It requires strong excitation at pressures of the order of 2 mm to bring them out. Their presence in the arc in CO is accounted for by the dissociation of CO and the subsequent formation of CO_2 during the passage of the discharge.

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[1] *Nature*, 117, 230, 1926.

[2] *Nature*, 117, 376, 1926.

THE RELATION OF NITRATES TO TOBACCO FRENCHING[1]

TOBACCO frenching is a disease in which the new leaves are chlorotic, especially between the veins. The leaves may be normal in shape but in severe cases are narrow and ribbonlike. They finally develop normal color. Although little is known in regard to the disease, it is generally believed to result from adverse soil conditions, especially poor drainage.

The past winter Turkish tobacco plants, growing in highly organic soil from a forest on the Kentucky Experiment Station farm, frenched, thus giving an opportunity for a study of the disease in pots in the greenhouse. A total of over two hundred frenched plants have been produced in soil and sand cultures. As quite definite results have been obtained both in producing the disease and in controlling it under greenhouse conditions, a short statement of the results obtained will be given.

[1] Published by permission of the Director of the Kentucky Agricultural Experiment Station.

In half-gallon jars of soil the disease usually appears in Turkish tobacco plants soon after the first evidence of nitrogen deficiency in the lower leaves. Frenched plants may be brought back to normal growth by the addition of a complete nutrient solution or by the addition of nitrogen in the form of calcium, sodium or potassium nitrate, ammonium sulfate, urine and other common sources of nitrogen. Recovery will also result when an excised top of a frenched plant is grafted on a healthy plant or when placed in tap water (containing a trace of nitrate) or in a complete nutrient solution or in a weak solution of nitric acid with an excess of calcium carbonate.

Soil which has produced frenched plants rapidly recovers its ability to produce a normal plant if allowed to stand a short time. The removal of one plant from a jar in which two frenched plants are growing will often result in recovery of the other.

These results and others of a similar nature suggest that frenching is brought about when the rate of carbohydrate metabolism proceeds relatively more rapidly than nitrogen absorption. This results in the production of leaf tissue which, in the absence of sufficient available nitrogen, can not develop chlorophyl and other necessary cell constituents as fast as they are required for the production of a normal green leaf.

The marked similarity between the symptoms of apple[2] and pecan rosette[3] and tobacco frenching suggests that the three diseases have a common cause; namely, a deficiency of available nitrogen. This is further strengthened by the fact that nitrates added to the soil bring about rapid recovery of frenched tobacco plants, while organic matter, especially legumes, plowed under has been found to bring about recovery of affected pecan and apple trees in the course of two or three years.

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A WIDESPREAD ERROR RELATING TO LOGARITHMS

THE integral part of a logarithm is commonly called characteristic, while the decimal fraction part thereof is known as its mantissa and is the only part of a common logarithm which is found in the usual modern table of logarithms. In view of the fact that students of mathematics frequently meet the word mantissa for the first time when they begin the study of logarithms it may be assumed that some of them are inclined to consult a large dictionary for the purpose of learning something about the origin of this word. If they should happen to look up this term in a recent edition of "Webster's New International Dictionary," or of "The Century Dictionary and Cyclopedia" they would find the statement that the noted British mathematician, H. Briggs, used the term mantissa with its modern mathematical meaning. They would find the same misinformation on consulting the most recent American text-book on the general history of mathematics, for the purpose of obtaining more light as regards the origin of this term.

In view of the fact that this error is so widespread in works which are naturally consulted by many readers with unusual confidence as regards their reliability it may be desirable to note here that as far as is now known the word mantissa was first used as a mathematical term by J. Wallis in the Latin edition of his algebra, 1693. This was more than sixty years after the death of H. Briggs. The word mantissa does not appear in the English edition of this algebra, which was published eight years earlier than the Latin edition and has been said to contain the word in question. J. Wallis used this word with a more general meaning than that noted above, and some very good recent writers, including H. Weber, have followed his example in this respect. Since I have previously directed attention to various errors appearing in F. Cajori's "History of Mathematics," 1919, it gives me pleasure to be able to say here that as regards the term in question his statement on page 152 is essentially correct.

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LITERATURE CITATIONS

MAY I add my bit to the discussion of literature citations from the standpoint of a user. The method of indication of references recommended by *Chemical Abstracts* has a logical sequence of arrangement.

In the case of a typical reference, J. Amer. Chem. Soc. **48**, 34 (1926), the first subject of interest is the journal, which thus refers to certain shelves in the library. This leaves a block containing the volume in heavy type or underlined in typewritten or handwritten notes, the page and the year. The volume, and series if more than one, are outstanding because of their location as the first item or items of the block, and because the volume is in heavy face type.

In general the reference is located by the volume number, in only isolated cases by the year. Only when the volume is located is the page reference of

[2] Morris, O. M., "Apple Rosette," Wash. Agr. Exp. Sta. Bul., 177, 1923.

[3] Skinner, J. J., and J. B. Demaree, "Relation of Soil Conditions and Orchard Management to the Rosette of Pecan Trees," U. S. Dept. of Agr. Dept. Bul., 1378, 1926.