solutions. The operator can not see the graduated scales while making the comparison and, therefore, can not be influenced by preconceived ideas. The work may be checked by making tests at different points throughout the length of the wedges, especially in cases where the color is too dense or too faint for the most accurate comparison at the first point tested.

The wedges are as easily emptied and filled as test tubes so that passing from one determination to the next is quickly and easily effected. If great rapidity is desired more than one set of wedges can be used. While one operator makes the comparisons, others can be preparing the determinations which are to follow. The possibility of using any section of the wedge from its thinnest to its thickest part renders the apparatus adaptable to a wide range of determinations, and permits of much variation in the quantity of substance taken for the test.

The colorimeter is sold by Eimer and Amend of New York City.

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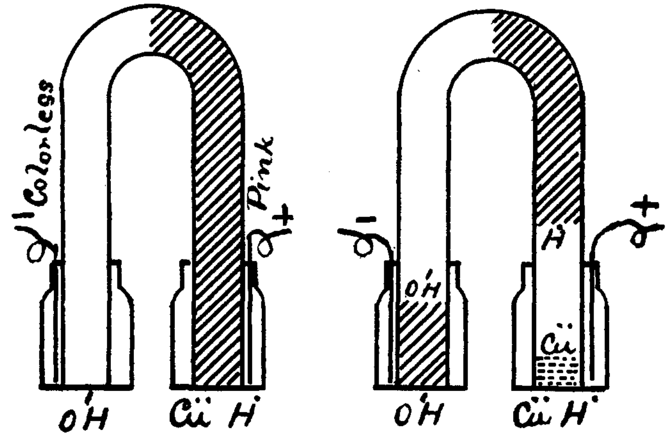
NOTES.

A Modification of a Previously Described Experiment on the Migration of Ions.—A lecture experiment illustrating the rates of migration of different ions was described some years ago by Noyes and Blanchard.[1] Unless this experiment is very carefully performed, it sometimes happens that the demonstration of the direction and relative speed of migration of the copper, hydrogen and hydroxyl ions is rendered inconclusive by the uneven front presented by the line of march. There frequently happens an irregular diffusion downward into spaces between the agar-agar and the walls of the U tube.



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[1] THIS JOURNAL, 22, 726 (1900).

This may be prevented and the experiment more simply and successfully performed in the following manner: Add one part of agar-agar to about five parts of boiling water, and after solution add potassium chloride, phenolphthalein and sufficient potassium hydroxide to color the solution pink. Completely fill a U tube with the mixture and by means of a pipet containing dilute hydrochloric acid passed to the bottom of one limb, discharge the pink color by allowing a small amount of the acid to escape and by stirring the mixture with the pipet as it is withdrawn. After congealment insert the pink limb of the inverted tube into a small bottle containing a solution of copper chloride and dilute hydrochloric acid, and the other limb into a bottle containing a solution of potassium chloride and potassium hydroxide, slightly inclining the tube, if necessary, to allow any entrapped air bubbles to escape.

Upon the application of the current in the usual way the migration proceeds in an orderly manner, and no skirmishers are sent on ahead. The process may proceed for days, if desired, and no cooling is necessary.

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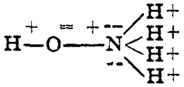
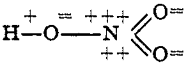
A Possible Explanation of Some Phenomena of Ionization by the Electron Theory.—Many chemists must have noticed the curious fact that ammonium hydroxide, H–O–NH_4, and nitric acid, H–O–NO_2, ionize, the first with the formation of hydroxide and the second with the formation of hydrogen ions, although in both cases a hydroxyl group is supposed to be combined directly with a nitrogen atom. The statement has, of course, been made that this is because the ammonium, NH_4, group is positive and the nitro, NO_2, group negative but these terms, "positive" and "negative," have been used in a very vague way, and with almost no thought of any genuin electrical properties. A possible explanation becomes apparent if we write the two formulas as follows, in accordance with the electron theory:





In ammonium hydroxide the nitrogen atom with its three extra electrons (it has gained four from the hydrogen atoms but has lost one to the oxygen atom) attracts the negative oxygen of the hydroxyl only feebly, hence, the group may easily separate by ionization. In nitric acid, on the other hand, the nitrogen atom has lost five electrons, becoming strongly positive. It holds the negative oxygen atom very strongly, therefore, but repels the positive hydrogen, causing this to ionize easily.

For the compounds $Na^+—O^=—H^+$ and $H^+—Cl^-$, the properties are evidently connected with the fact that the sodium atom readily loses an electron but can not, apparently, take one from another atom. This may be because the positive part of the atom is so deep in its structure that it exerts little attraction for the electron and little, also, for the negative oxygen. The ease with which metals give up electrons seems to be closely connected with their properties as electrical conductors, though I am not aware that this connection has been pointed out before. It may also be connected with the character of the spectra of metals, the electron of the sodium atom being possibly in orbital motion around it, as Lorenz and others have supposed.

In hydrochloric acid the electron gained by the chlorine atom may perhaps penetrate the atom so deeply as to exert but little attraction for the hydrogen. But it is to be remembered also that while the chlorine atom may take up one electron it may give up seven electrons to other atoms, especially to oxygen.

The speculative character of the suggestions here given, is, of course, clearly recognized. It seems possible, however, that we may sometime know the structure of atoms as we now know the structure of molecules, and it is, perhaps, worth while to indicate some of the lines along which it may be possible to attach problems of this sort. W. A. NOYES.

URBANA, ILL.

[CONTRIBUTION FROM THE DEPARTMENT OF CHEMISTRY, UNIVERSITY OF CINCINNATI.]

A CRITICAL SURVEY OF SOME RECENT APPLICATIONS OF THE ELECTRON CONCEPTION OF VALENCE.

BY HARRY SHIPLEY FRY.

Received January 2, 1912.

The purpose of this paper is to present some applications of the electron conception of valence and to discuss their bearing upon the assumptions postulated by K. George Falk[1] in his article on the electronic structure and ionization constants of the organic acids.

Falk states that the organic acids may be divided into four classes in which the ionization constants ($K \times 10^5$) depend primarily upon the additive effects of the directive valences of the α-carbon atom. The principles upon which the direction of valences are assumed to depend are based upon the corpuscular-atomic hypothesis of Sir J. J. Thompson according to which the linkages or bonds between the atoms in a molecule are formed by the transfer of corpuscles or electrons.

Under the sub-title of "Theoretical Considerations" Falk records the following statements:

(A) "The principles upon which the directions of valence are assumed to depend were explained in the first paper. (THIS JOURNAL, 32, 1637–54.) It may suffice to

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[1] THIS JOURNAL, 33, 1140 (1911). "The Electron Conception of Valence." II. "The Organic Acids."