

(as well as an apical leaf) send out substances toward the base of a stem which inhibit the buds from growing out. These inhibitory substances may be identical with or may accompany the root-forming hormones. The most apical bud in an excised piece of stem will grow out first since it will be the first to be free from these inhibitory substances.

In a former paper the writer had pointed out that a leaf sends out substances, in an apical direction through the stem, which favor shoot formation.

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#### SOME COMMENTS ON THE THEORIES OF THE STRUCTURE OF MATTER<sup>1</sup>

PROFESSOR LEWIS in his paper raised the question of valence. From the point of view of chemistry, valence has a definite meaning which can not be overlooked and which may be emphasized here. The conception of valence developed from a study of the regularities observed in the composition of substances, and is fundamentally purely descriptive. It is a classification which shows regularities in the capacity of certain atoms for combination, or for holding a definite number of atoms or their equivalents in combination. The continued study of chemical composition has, as a matter of course, extended the classification. The phenomena of oxidation, the ionization of substances in solution and otherwise, and similar properties, have brought forward the view that, choosing a suitable element or state of an element as the zero or neutral point, the valence of an element in a given combination may be denoted either by a

positive number or a negative number. This view was adopted for individual cases some time ago by different chemists, but became of general interest when J. J. Thomson, using corpuscles, showed how this could be pictured readily, and applied in a simple manner.

A few words may be devoted to the fact that the classifications given by valence should involve no considerations of measures of relative stabilities of substances, although the existence of compounds depends upon stabilities and rates of decomposition. Stability discussions should not enter directly into questions of valence, but unfortunately this fact is often overlooked and much confusion has resulted.

The question of so-called polar and non-polar valence is one raised by Professor Lewis. At the present time the view that only non-polar bonds exist is probably held by no chemist. The electron conception of valence, based upon a study and comparison of organic and inorganic compounds, postulates polar valence only; in other words, each valence linking is equivalent to one atom functioning with a negative charge, and the other atom with a positive charge. The electrostatic view does not involve at first sight such questions as distribution of electrons within the atom, etc.

At the present time there are a number of chemists who advocate both polar and non-polar valences, even assuming both to be present in a molecule at the same time. The reasons for assuming the existence of non-polar valences appear to be negative ones. If direct evidence is lacking, or if ignorance is manifested with regard to the reactions of certain groups, or if these groups do not take part in the desired reaction with sufficient velocity, the existence of polar valences is denied. A strong argument in favor of assuming polar valences in organic compounds is, that if they are

<sup>1</sup> This discussion was presented by Dr. Falk at the "Symposium on the Structure of Matter," held at the meeting of the American Association for the Advancement of Science in New York City, December, 1916.

not assumed, two different types of oxidation reactions become necessary, and these two types would be contradictory. This was pointed out several years ago.<sup>2</sup>

Direct evidence for the polar nature of valences involved in the Grignard reactions is given by some recent experiments.<sup>3</sup> Without going into details, these results may be quoted.

RESISTANCE IN OHMS. (ORDINARY CONDUCTIVITY APPARATUS)

Ether .....	above 1	$\times 10^7$
Ether containing ethyl bromide..	above 1	$\times 10^7$
Ether containing 1.2 gm. magnesium as Grignard reagent		
( $\text{MgC}_2\text{H}_5\text{Br}$ ) per 100 c.c.....	7.1	$\times 10^8$
Same with 0.3 mg. magnesium..	1.0	$\times 10^8$
1/50 M KCl aqueous solution....	1.26	$\times 10^2$

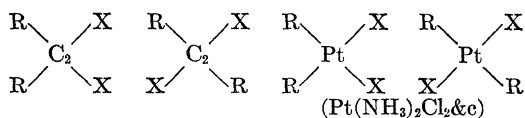
A cell constructed with magnesium and platinum electrodes, and a dry ethereal solution of ethyl bromide containing a small amount of previously prepared Grignard reagent as solution gave electromotive forces of from 0.5 to 1.5 volts.

These results are of the greatest significance with regard to the question of polar and non-polar valence and indicate that the valence or linkings of organic compounds are of the same character as those of inorganic compounds. They bear out the explanation of the Grignard reaction on the basis of the electron conception of valence published several years ago, and in addition will unquestionably throw light on the processes operating in solutions, aqueous and otherwise.

With regard to Professor Jones's work on electromerism, some interesting developments may be presented. As we understand the term, electromerism means electronic tautomerism and includes substances structurally identical, but mutually transformable by an exchange of negative electrons between atoms composing the mole-

cules. Thus ammonium nitrate,  $\text{NH}_4\text{NO}_3$ , and hydroxylamine nitrite,  $\text{NH}_2\text{OH NO}_2$ , while mutually transformable by a suitable exchange of negative electrons, since as far as the charges on the atoms are concerned they differ only in the valence of the nitrate and nitrite nitrogen atoms, are not structurally identical and would not, therefore, be classed as electromers.

Professor Jones in his paper considered electromeric nitrogen compounds. In electromers, the states of oxidation of certain atoms in the structural isomers are different. A number of years ago we showed that the explanation of the isomerism of a number of structurally identical organic compounds may be referred to the state of oxidation or the valence of certain atoms. The compounds referred to are generally known as geometrical or cis-trans isomers. Direct evidence based upon the ionization constants of organic acids<sup>4</sup> showed that the isomerism of maleic and fumaric acids is due to phenomena now included under electromerism while addition reactions of unsaturated carbon compounds lead to similar conclusions.<sup>5</sup> The evidence in detail is given in the published papers and need not be repeated here. It is possible to go somewhat farther. Werner and Pfeiffer<sup>6</sup> have placed in parallel the so-called geometrical isomerism of double bonded carbon atoms and the isomerism due to plane configuration of certain cobalt, chromium and platinum compounds:



<sup>4</sup> Falk, *Jour. Amer. Chem. Soc.*, 33, 1140 (1911).

<sup>5</sup> Nelson and Falk, *School of Mines Quarterly*, 30, 179 (1909); Falk and Nelson, *Jour. Amer. Chem. Soc.*, 32, 1637 (1910).

<sup>6</sup> Werner, "Neuere Anschauungen auf dem Gebiete der anorganischen Chemie" (1913), pp. 343, 345; Pfeiffer, *Ztschr. physik. Chem.*, 48, 40 (1904).

<sup>2</sup> Falk and Nelson, *Jour. Amer. Chem. Soc.*, 36, 209 (1914).

<sup>3</sup> Nelson and Evans, *ibid.*, 39 (1917) (January).

Whatever explanation is accepted for the double bond isomerism, the same explanation will apply to the isomerism of the platinum compounds. Werner considers that the explanation of the spatial configuration applies to both. On the other hand, if the double bond isomerism is due to the directions of the valences which is the same as the distribution of the negative electrons in the acids, then the explanation of the isomerism of the platinum compounds should be based upon the distribution of the electrons in the platinum atom. There is, however, only one atom involved here, so that it appears as if this isomerism would furnish a method for showing the distribution or arrangement of the electrons in an atom, or perhaps the spatial configuration of the atom, different arrangements of electrons giving rise to possibilities of the existence of isomeric compounds. It is even possible, and perhaps very probable, that the different arrangements of the electrons might control the spatial positions of the combined groups. The spatial configurations deduced by Werner and others, then would exist, but would actually be an effect of the arrangement of the electrons. The positions of the combined atoms therefore would be a result of the isomerism and not its cause.

These platinum and similar metal compounds would then belong to the class of electromeric substances. Since this explanation means that the spatial arrangement of atoms or groups around a central atom depends primarily upon the spatial arrangement of the valence and also other electrons of that central atom, a further logical deduction would include all optically active isomers in organic and inorganic chemistry in the group of electromers. The spatial arrangements of the atoms or groups here would also be governed or controlled primarily by the arrangement of the elec-

trons of the atom showing the optical activity.

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#### POSSIBILITY OF USING GRAVITY ANOMALIES IN THE SEARCH FOR SALT-DOME OIL AND GAS POOLS

THE immense masses of common salt that have forced their way up toward the surface of the earth in Louisiana, Texas and other low plains regions where there is no hard rock within several thousand feet of the surface, seem to afford all the fascination and baffling questions that can be desired by the structural geologist, though thrilling encounters with such questions are usually sought in mountainous regions. Recorded and available notes on experiences in the sinking of the thousands of wells that have been put down on salt domes in the search for oil is dishearteningly scant, and yet sufficient to give a fair idea of the common extents, positions and shapes of the upper portions of the salt cores. If as much were known concerning their lower portions it might not only be possible to determine their cause and mode of growth with a fair degree of certainty, but to devise means of discovering by gravity observations, hidden domes, for some are scarcely evident from the surface, and perhaps many unsuspected ones with valuable oil and gas pools are scattered through the coastal portions of Louisiana, Texas and other regions.

Are the salt domes due to some process related to volcanic action? The domed form of the strata, which is much more commonly seen than the core itself, is such as might have been produced by a rising plug of igneous rock and even the masses of salt and associated secondary deposits might apparently have been produced indirectly by intrusions. On the other hand, though many very deep wells have been drilled in salt domes, igneous rock has rarely if ever been touched. Since there are numerous varieties of salt domes—some making a