A NEW APPROACH TO FIRST YEAR CHEMISTRY

G. M. SCHMEING
Loyola University, Chicago, Illinois

ABSTRACT

Amplification of the paper of the above title consisted in listing the experimental, factual basis and the application. A fresh presentation of first year chemistry is sought to avoid confusion in the mind of the beginner.

Chemistry relates the prescription, testing and production of materials to their properties and these in turn to their structure. The properties exhibited by a statistical aggregate of even very similar particles are not always the properties exhibited by an individual particle of the aggregate. Interest in physical properties can be stimulated by studying them in connection with the instruments used in their measurement.

In the discussion of structure and its relation to properties distinction must be made between the electron considered as a unit of measure and as a structure. The same distinction can be applied to the word atom. We must also distinguish between a structure and our model of it.

Some of our present knowledge of the structure of materials may be stated as follows. Material structure is the result of an interplay of electric, magnetic and geometric fields. Centers of wave interference exhibit the properties of particles. One such particle is the nucleus, positively charged, surrounded by a negative charge distributed in concentric, hollow, more or less spherical shells. The density of the shell diminishes gradually but rapidly both toward and away from the center. The shell nearest the nucleus may contain as a maximum enough material to furnish two electrons. The shell nearest the nucleus may contain as a maximum enough material to furnish eight electrons, two from one sub shell and six from another. The shell third from the nucleus may contain as a maximum material enough to furnish eighteen electrons, two from its first sub shell, six from the second and ten from the third. The shell fourth from the nucleus may contain as a maximum material enough to furnish thirty two electrons, two from the first sub shell, six from the second, ten from the third and fourteen from the fourth.

The variables associated with the nucleus are: charge, always positive and quantized; mass, quantized; and energy content, quantized. The variables associated with the negative charge about the nucleus are: charge, always negative and quantized; mass, negligible for many purposes; energy content, quantized; and distribution in shells and sub shells.

If the positive charge on the nucleus is equal to the negative charge around the nucleus we call the resulting structure an atom; by taking account of the variables of nucleus and of surrounding negative charge the number of kinds of atoms may be found. If the nuclei of two atoms have quantitatively the same positive charge but differ in mass the one atom is said to be an isotope of the other, whereas if the nuclei have the same mass but differ in charge the one atom is said to be an isobar of the other. If marked stability is a characteristic of the structure we call it a mononuclear molecule.

If the structure exhibits more than one nucleus all of them surrounded by and inbedded in the same negatively charged field in which the interpenetration of contributing negative fields produces a volume or volumes of denser negative charge holding together the positively charged nuclei, we must distinguish several cases.

If the nuclei are all of one kind and if the sum of the positive charges on the nuclei equals the surrounding negative charge we have a polynuclear molecule of an elementary substance; if the sum of the positive charges on the nuclei is greater than the surrounding negative charge we have a poly-homonuclear cation; if the sum of the positive charges on the nuclei is less than the surrounding negative charge we have a poly-homonuclear anion.

If the nuclei are not all of one kind and if the sum of the positive charges equals the negative we have a poly-heteronuclear molecule of a compound

TABULATION

1 nucleus
- $+ = -$; atom.
  - masses $=$, charges $\neq$; isobars.
  - " $\neq$, " $=$; isotopes.
  - very stable; mononuclear molecule, He.
- $+ > -$; mononuclear cation, $Na+$.
- $+ < -$; " anion, $Cl-$.

more than 1 nucleus
- all of 1 kind
  - $+ = -$; poly-homonuclear molecule of an elementary substance, O_2.
  - $+ > -$; " " cation
  - $+ < -$; " " anion, I_3-
- not all of 1 kind
  - $+ = -$; poly-heteronuclear molecule of a compound substance, CH_4.
    - center of charge $=$ center of gravity; non polar, CH_4.
    - " " " $\neq$ " " " "; polar, H_2O.
  - $+ > -$; poly-heteronuclear cation, NH_4+.
  - $+ < -$; " " anion, $SO_4=$.

substance; if the centers of positive and of negative charge and the center of gravity are coincident the molecule is nonpolar; if these centers are not coincident the molecule is polar; if the sum of the positive charges is greater than the surrounding negative charge we have a poly-heteronuclear cation; if the sum of the positive charges is less than the surrounding negative charge we have a poly-heteronuclear anion.

By continuing this enumeration of combinations, descriptions in terms of structure are supplied for the various kinds of ion sets, solutions, alloys and mixtures. The result is a univalued terminology structurally related to the properties exhibited by the materials so classified.