New Trends in Chemistry Instruction

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The subject matter of the general chemistry course is rapidly increasing. One has but to compare the physical size of current revisions of long-used texts with their predecessors to reach this conclusion. How are chemistry instructors going to handle the vast accumulation of facts at their command? How much should they attempt to impart to their students? Happily, there is a trend toward minimizing strictly factual content and expanding study and rationalization of general principles by which all chemical behavior can be predicted. This eliminates "pin-pointing" the study toward specific elements and compounds and allows them to be studied in general groupings. A solid foundation for all chemical behavior can be built upon three principles. These are: the Atomic theory, Kinetic-Molecular theory and Periodic law.

Perhaps it is high time for scientists to elevate the first two to the status of laws. This past summer the writer had the pleasure of sitting at the discussion table with Dr. Linus Pauling in the American Chemical Society Conference and Workshop on General Chemistry held at Oklahoma A. & M. College. The question arose as to what amount of scientific skepticism should be shown toward atomic and molecular structure by chemistry teachers. Most of the group seemed to be of the opinion that until these particles could be clearly seen, they should be treated doubtfully. At this point Dr. Pauling strongly objected, "They are real! I have seen them!" There followed a momentary silence. During that silence most of us must have gained a deeper insight into the reality of the Atomic Era in which mankind is now irrevocably plunged.

Perhaps we should not begin our course with studies of such mild things as oxygen and rusting any longer. New and more awesome chemical changes have catapulted over the horizons of knowledge. Infinitesimal bits of matter are being transmuted into avalanches of energy. Metaphorically speaking, Pandora's Box has been opened and the secret is out. Everything is energy, manifest or potential and the vast majority of it merely stored as matter.

Where is the boundary line between the living and non-living? Dr. Wendell M. Stanley of the Rockefeller Institute looked through an electron microscope some six years ago and saw molecules of tobacco mosaic virus. Just plain chemical molecules—but hold on!—these molecules were growing, and mutating! and reproducing!—all in the absence of life cells. Dr. Pauling

recently announced the determination of structure of potein molecules which had mystified chemists for almost a century. The molecule is already a proven and seen fact. The atom may soon be placed in the same light.

Dr. Malcolm Correll presented a paper before this group two years ago entitled: "The Need for Philosophy of Science in Science Education". That is a very appropriate consideration for these times. We need to think deeply and seriously about our aims. Not only in natural science but social science as well. We ought to convey this need for a new human philosophy across the lecture table. There is a distress call in the world today for mature minds, and mental maturity is shockingly scarce. Some may say that a chemistry teacher doesn't have time for these things. Most of us will agree however that our progress in natural science has surpassed that of social science to a dangerous extreme. It is the duty of all true educators to "take up the slack" before man is destroyed by his own actions. A few well chosen words subtly imparted at the right moment would be a great help and what more convincing moments can be found than when actually studying these new and terrible forces which mankind has mastered?

A study of the atom and its behavior in the formation of molecules should follow, assuming the student has been made familiar first with basic units of scientific measurement. This is the chief departure from the chemistry program of the past. The consensus of opinion and practice among chemistry instructors is rapidly moving away from the classical treatment of individual elements and compounds under the mechanistic system of history, occurrence, preparation, physical and chemical properties and uses. It is moving toward the emphasis of structure. Many mysteries of the past are being solved through our improved knowledge of atomic and molecular structure.

The usual descriptive study of the elements should be in terms of group behavior according to the best modern concepts of periodic arrangement. A panoramic view of the chemical behavior of all matter is most effectively realized by this type of treatment. The student is provided with a tool which will cut through bewildering numbers of facts and arrive at fundamental cause and effect relationships which make for faster and more independent thinking and visualization of the problem at hand. Rote memory is discouraged and purposeful correlations are stimulated which result in more satisfying intellectual experiences. These are more likely to be retained and used than groups of isolated facts concerning specific substances.

Aside from content as such, a more important factor of the general chemistry course, the most important in fact, is the instructor himself. Much of the knowledge he imparts soon will be forgotten by the students but the effect of the teacher's personality can vitalize or destroy the students' motivation and progress in education. This must be considered always in planning the course material. No teacher worthy of the title will submerge himself beneath his notes and fret because he was not able to parrot a page or two of extra information on a given day for lack of time. Instead, he will listen to the student. Find out his reactions and give his opinions critical audience. If this is done, a wonderful thing will happen. The student will think, study and express himself. He will show spontaneous interest. He will demand more knowledge. In short, he will learn to educate himself. A sure sign of maturity! One good teacher can help immeasurably in a transition from the spectre of atomic chaos and destruction of a new era of prosperous harmony between men and the atoms of which they are composed.

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