CHEMISTRY[1]

Chairman: R. L. Hicks, Franklin College

E. L. Haenisch, Wabash College, was elected chairman for 1952

ABSTRACTS

A course in the nature of matter-energy for the first semester of general chemistry. George A. Scherer, Earlham College.—The objective of the course is to present the broad concepts of the present-day views of the nature of matter-energy. It should be followed by a descriptive course about the properties, preparation and uses of specific kinds of matter.

The course begins with a consideration of the fundamental particles of matter (electrons, protons, neutrons, etc.), followed by the usual classification of matter and the study of the changes of matter, including the laws of chemical changes.

The presentation of the structure of matter explains the periodic system, valence, radioactivity, nuclear fission, etc. In the same way the gas laws, the kinetic molecular theory and crystal structure grow naturally out of a study of the states of matter.

The dispersed condition of matter includes a treatment of colloids, solutions, electrolytes and Faraday's laws of electrolysis. Acids and bases are presented according to the proton theory. The course closes with a study of equilibrium.

The laboratory work contains many of the usual experiments illustrating the laws, principles and processes mentioned above. New Radioactivity and Periodic System and Atomic Structure.
experiments used are Wave Nature of Electrons, Ionization Potentials,

When is an equation balanced? R. L. Hicks, Franklin College.—

The non-science one-semester course in organic chemistry. E. Campaigne, Indiana University.—In determining the material to be presented in a one-semester course in Organic Chemistry for non-science majors, it is important to have a clear understanding of the specific objectives of the course, and the nature and composition of the student body of the course. Most important in the latter respect is a knowledge of the previous chemical training of the student. In most cases for this type of course the student has had one semester or one year of general chemistry.

The chief purpose of such a course is to impart a cultural knowledge of organic chemistry, so that current newspapers and magazines

[1] Several of the abstracts are from a panel discussion on "What Should Be Included in the Chemistry Curriculum of a Small Liberal Arts College?"

dealing with such topics as petroleum products, synthetic rubber, drugs, synthetic blood plasma, etc., can be read with some understanding. To achieve this objective with a student body having only one semester of general chemistry requires careful elimination of much of the material usually given in the year-course in Organic Chemistry, plus careful choice of illustrative material which will relate the student's everyday experiences to the field.

In the choice of experiments for the laboratory, it is also important to have clearly in mind the purposes of the course. The acquiring of technique and special skills is not important for these students, and therefore experiments requiring isolations of products in high yield and of great purity should be minimized. The laboratory should be used chiefly to acquaint the student with organic materials, and to illustrate the lecture. Therefore many test-tube experiments and demonstrations can be used. This serves to speed up the work, and permit coverage of all of the field in one semester.

The course content and the pros and cons of teaching aliphatic and aromatic chemistry together will be discussed.

The second semester of general chemistry for a small liberal arts college. DONALD J. COOK, DePauw University.—The situation usually encountered in the small liberal arts college is one where students who are majoring in other fields besides chemistry are all in the same course. This presents a problem as to what should be presented in such a course so that it will not be too difficult for the non-chemistry major, but still adequate for the chemistry major.

By emphasis on properties of matter as related to inorganic substances, structural inorganic chemistry, complex ions, equilibrium involving common ion effect and Mass Law and by requiring the student to convert what is seen in the laboratory to a logical chemical statement in the form of a balanced equation, the primary goal of giving all students something which is interesting and useful will be accomplished.

So that the lectures and laboratory work can be integrated, it is necessary that the order in which the study of the elements and their compounds is undertaken must follow as closely as possible the ordinary scheme of qualitative analysis as covered in most text-books.

A course in second semester General Chemistry which is conducted with the above motives should, to a great extent, correct the lack of general knowledge of inorganic chemistry which has been evident in chemistry majors from Liberal Arts Schools.

The physical chemistry course in a small liberal arts college. FRANK T. GUCKER, JR., Indiana University.—We may consider three main objectives in a college course in physical chemistry: (1) a description of phenomena and facts, (2) the understanding of experimental methods and their limitations, (3) mathematical correlation of facts and their theoretical interpretation in terms of the laws of thermodynamics and the kinetic theory.

A purely descriptive course with a minimum amount of mathematics is worthwhile for premedical students and those in some of the biological sciences, while a more mathematical course making use of calculus is necessary for students of chemistry, physics, and mathematics. If there are not enough students to warrant both a nonmathematial and a mathematical course in physical chemistry, all of the students can be put into a descriptive course, followed by a one-semester course in elementary thermodynamics, covering the mathematical aspects of physical chemistry.

First-hand information on the reliability of experimental methods is best gained by laboratory work. Much of this can be done with fairly simple equipment, easily within the range of small liberal arts colleges. Students may cooperate on many experiments, and these may be carried out in rotation to reduce duplication of equipment, although the laboratory work cannot then be in step with the lecture material. A group of 26 simple laboratory experiments, mostly taken from the compilation by Professor Ralph L. Seifert, were discussed. These included studies of gases, liquids, solids, thermochemistry, liquid pairs, solutions, chemical kinetics, electrolytes, electrochemistry, surface chemistry, and phase rule.

The content of the qualitative analysis course. NED GUTHRIE, Hanover College.—The content of the course depends upon the background of the student. A more comprehensive course can be presented if the student has a full year of general chemistry in college.

Qualitative analysis is an excellent tool for teaching inorganic chemistry and the applications of elementary principles of physical chemistry to the field of inorganic chemistry. The methods of analysis should be organized around the fundamental laws and theories of chemistry such as the periodic table, law of chemical equilibrium, theory of atomic structure and its applications. The student also has the opportunity to become acquainted with many inorganic substances.

Laboratory work consists of experiments to collect and organize data which is useful in separations and identifications; the analysis of knowns and unknowns.

Most text books are weak on the thought provoking type of questions which helps the students to understand the chemistry involved in the analysis.

Principles of any science have very little meaning to the student until he has had considerable experience in using the laws and theories by applying them to various problems. The course in qualitative analysis is an excellent tool for presenting the fundamental principles of physical inorganic chemistry.

Analytical chemistry—quantitative analysis. EDWARD L. HAENISCH, Wabash College.—The time devoted to quantitative analysis depends on the place occupied by qualitative analysis and instrumental analysis in the chemistry curriculum. For pre-medical students it is also influenced by the content of a possible course in pre-medical physical

chemistry. At Wabash College a sophomore course has been devised wherein everyone takes a common first semester. This consists of qualitative analysis by semi-micro methods for a half term and quantitative analysis, primarily the practice, physico-chemical theory and stoichiometic calculations of neutralization, for the second half. During the second semester everyone takes two lectures in common over a similar treatment of gravimetric analysis (including electrodeposition), volumetric precipitations, redox methods and simple spectrophotometry. The chemistry majors analyze alloys, ores, minerals, etc., during six hours of laboratory weekly. The pre-medical students have a third classroom period to cover additional physico-chemical topics such as gases, solutions and kinetics. In the laboratory these students work three hours weekly and perform simpler analyses than the chemists. In addition they use a pH meter, do electrometric titrations and measure pH colorimetrically. Of eight semester hours in sophomore chemistry the pre-medical students obtains 2 credits in qualitative analysis, 3 in quantitative analysis and 3 in pre-medical physical chemistry. Chemistry majors take an additional senior course in instrumental methods.

The measurement of low pressures at high temperatures. W. H. JOHNSTON and A. W. SEARCY, Purdue University.—The present techniques for the continuous measurement of pressures are extremely difficult to apply at temperatures above 1,000° C. The need for such measurements in vapor pressure studies at very high temperatures has led the authors to design an apparatus for this purpose.

A substance containing a radioactive tracer is vaporized onto a moving tape which passes in front of a shielded Geiger counter. The continuous recording of the output of the counter is calibrated to give the pressure in the vaporization chamber.

Gas phase exchange reactions. W. H. JOHNSTON, Purdue University.—The recent availability of a great variety of stable and radioactive isotopes has made possible the systematic study of exchange reactions in the gas phase. These reactions are discussed in general terms, noting their relationship to ordinary chemical reactions and their importance to chemical kinetics.

A number of specific examples are given with special emphasis on the author's work on the hydrogen chloride-chlorine and the chlorine-chlorine systems.

The reducing action of Grignard reagents on fluorinated carbonyl compounds. E. T. MCBEE and OGDEN R. PIERCE, Purdue University.—The reactions of six Grignard reagents with both trifluoroacetaldehyde and pentafluoropropionaldehyde were studied in order to determine if the amount of fluorine present in the aldehyde affects the degree of reduction and to evaluate the effect of the structure of the alkyl group of the Grignard reagents on the product obtained. In addition, the study was extended to the action of ethylmagnesium iodide on esters of trifluoroacetic, pentafluoropropionic and heptafluorobutyric acids as well as 1,1,1-trifluoroacetone, 3,3-4,4,4-pentafluoro-2-butanone, 3,3,4,4,5,5,5-heptafluoro-2-pentanone, and heptafluorobutyraldehyde.

The products of the reaction of trifluoroacetaldehyde and isopropyl magnesium iodide were trifluoroethanol in 87% yield, and propylene. In the reaction of ethyl magnesium iodide with trifluoroacetaldehyde and pentafluoropropionaldehyde, a very much larger ratio of reduction to addition was obtained with the latter compound. The inductive effect of the fluorinated alkyl groups is believed to account for the abnormally high yield of reduction products produced with Grignard reagents having beta hydrogens. Mechanisms are proposed for the addition and reduction reactions.

The silicides of the transition metals. ALAN W. SEARCY, Purdue University.—Practically all that we know of the chemistry of the metal-silicon compounds was learned fifty years ago by men working with impure materials and without the aid of x-ray diffraction equipment. Because of the great experimental obstacles to the work at that time, some metal silicides were incorrectly identified and many more were overlooked. In the past thirty years many metal silicides have been unambiguously identified by x-ray diffraction analysis, but the properties of these silicides have not been studied. In the present paper the chemical and physical properties of the transition metal silicides are discussed in light of the old chemical information and the recent structural information. The elements that form the most stable silicides are the same as those that form the most stable carbides. The high melting points, the hardness, brittleness, electrical conductivity, and chemical inertness of the silicides are all properties similar to those of the so-called interstitial carbides even though silicon atoms are too large to enter a metal lattice interstitially. Clearly, the influence of the interstitial crystal structures on physical and chemical properties of carbides has been exaggerated.

Mono- and di-valent gaseous compounds of boron and aluminum. ALAN W. SEARCY, Purdue University.—Until recently it appeared that only compounds of boron and aluminum could be prepared in which the metal is tri-valent. In 1940, however, Zintl, Morawietz, and Gastinger[1] reported that when boron and zirconium dioxide were heated together a mono- or di-valent gaseous oxide of boron was evolved. Other workers have since shown that the compounds AlF, AlCl, AlBr, AlI, Al_2O, Al_2S, and Al_2Se exist as gases. None of these compounds has been prepared in the solid state. Methods of studying the gaseous lower halides are discussed, and a brief description is given of unpublished investigations by Daniel Barry and A. W. Searcy which indicate the evolution of a mono- or di-valent chloride of boron when boron trichloride is passed over boron metal. The binding energy in gaseous BCl is discussed.

Organic chemistry—usual one year course. T. C. SCHWAN, Valparaiso University.—There is fairly good agreement on course content, but not on order of presentation of material. Content should include

[1] Zintl, E., W. Morawietz, and E. Gastinger. 1940. Bormonoxide. Zeitschrift fur Anorganisch Chemie. **245**:8-11.

an intensive study of basic organic chemistry emphasizing, in decreasing order of emphasis, nomenclature, properties, reactions, occurrence, preparation, uses and history. The course should begin with a gradual transition from inorganic to organic chemistry beginning organic chemistry proper with the hydrocarbons and continuing with simple derivatives such as halides until the more complex functional groups and combinations have been covered. Aromatic compounds should be presented with alphatic compounds. There should be at least a brief introduction to heterocyclic compounds.

The laboratory work should extend and emphasize a well balanced variety of experiments illustrating techniques, reactions by test tube experiments, preparations taking into account side reactions and purification procedures and a brief introduction to qualitative organic chemistry with unknowns being given for identification throughout the course.

A laboratory text which requires the student to formulate his own laboratory directions might be used as a means of avoiding "cookbook" laboratory procedures.