

Group 11 - Main Topics of Four Year Chemistry Curriculum

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At the beginning of the first session a large number of unrelated topics were put forth to provide a basis for discussion. The group then decided to choose a smaller number of broad headings by which the various detailed topics could be organized in a logical manner. After considerable discussion the broad headings chosen were:

- 1) Structure of Atoms, Molecules, and Aggregates
- 2) Energetics
- 3) Descriptive Chemistry or Chemical Behavior
- 4) Techniques, or Chemical Arts
- 5) Scientific Method and Outlook

Each of these areas was then discussed separately in order to choose the most important topics in each area. It should be emphasized that these topics are not subjects of specific courses. Whatever the course structure in the curriculum, it is believed that these topics will be repeated, at different levels, in every course in chemistry.

I. Structure of Atoms, Molecules, and Aggregates

A. Atomic Structure

Atomic orbitals and the qualitative significance of the wave equation
Wave-particle duality
A limited discussion of nuclear structure and stability
Isotopes
Relationship to the periodic table, ionization potentials and spectra

B. Molecular Structure

Bond types
Valence bond method
Molecular orbital method
Electronegativity and resonance
Orbital geometry and stereochemistry

C. Kinetic theory of Gases, Liquids, Solids, and Solutions

II. Energetics

A. Equilibrium

Conservation of matter and energy
Heats of reaction
The 2nd law of thermodynamics and chemical equilibrium
Phase equilibria
Galvanic cells
Activity coefficients
Partition functions and the statistical approach
Application to real processes

- B. Kinetics
 - Rates of reactions
 - Order and mechanism
 - Collision theory
 - Activated state treatment
 - Catalysis

III. Descriptive Chemistry or Chemical Behavior

This discussion did not lend itself to outline treatment. The main conclusions were that sufficient descriptive chemistry should be covered to provide for testing the concepts and theories as well as to provide examples of phenomena which are not now well explained. The necessity of correlating behavior with the periodic table and structure whenever possible was emphasized. The obvious necessity to relate chemistry to other disciplines and to practical applications was reiterated. It was agreed that the laboratory should be a means of obtaining knowledge of chemical behavior as well as illustrating material learned in the classroom. Some knowledge of the sources of organic and inorganic compounds as well as their properties seemed necessary to the group. The concept of the functional group and the interaction between functional groups was considered of primary importance in systematizing chemical behavior.

IV. Techniques, or Chemical Arts

The conventional laboratory techniques, such as weighing, measurement of volume, distillation, crystallization, titration, glassworking, preparation of compounds, measurement of potential and resistance, etc. were essentially taken for granted and subsumed under the heading of "unit processes in chemistry".

The ability to use the library and to find information in the chemical literature was considered to be of primary importance, as was the ability to present the results of laboratory experiments and reading in oral and written form.

Many members of the group felt that experience in independent research resulting in a thesis is a necessary part of the undergraduate program, but this was not by any means unanimous.

Some stressed the danger of learning to use complex instruments without knowledge of the basic principles involved.

V. Scientific Method and Outlook

The main points emphasized under this topic were the following:

The necessity to view chemistry as a continuously developing and changing body of observations and theories, a creation of the human mind, in which the concepts are all tentative, subject to change in the light of new observations and new theoretical insights.

The necessity to be aware of the place of chemistry among the sciences and the place of science among the fields of knowledge.

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