

New Science-Technology-Society Syllabi for 70,000 Students of Colegio de Ciencias y Humanidades (CCH) In Mexico City

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The Colegio de Ciencias y Humanidades (CCH) is a high school system of the National University of Mexico (UNAM) that has a population of seventy thousand students.

Our educational goal is to form conscientious citizens well prepared for positive interaction with the social, politic, economic and natural environment, and with a solid knowledge that will enable them to continue their studies.

Last year we changed the curriculum so that the relations among science, technology, and society are more relevant. The new curriculum has two required courses and two optional courses per semester. We will discuss the required courses.

We have a student centered curriculum that takes into account the students' subjects of interest. Our students are urban teenagers with little motivation and poor academic abilities in science. Chemical education is designed to help students grow in their scientific understanding of nature through the knowledge and comprehension of the basic concepts of chemistry, and to acquire intellectual skills and attitudes for the rational use of technology leading to sustainable development.

Our goal is to generate in the students interest and knowledge in chemistry and to help them develop a sense of responsibility and commitment to their country and to the conservation of the environment.

The interrelationship among science, technology and society, in connection with Mexico City's environmental problems provides the opportunity to pose questions about significant problems in the students' everyday life and to encourage their process of inquiry.

Students are active learners in this process. They must search for information while designing and developing experiments and consult diverse printed matter such as textbooks, periodicals, etc., in order

to elaborate a working model for problem solving.

This work allows students to learn basic concepts in chemistry and to develop skills and attitudes related to the intellectual processes and abilities associated with both the practice of science and the awareness of their responsibility to protect the environment, through a rational use of science and technology.

Because of their importance in explaining chemical changes, we expect the student to learn some basic concepts through the courses of Chemistry I and Chemistry II. These are: element, compound, mixture, chemical bond, chemical reaction, structure of matter and matter classification.

These concepts are studied in every unit, each time at a deeper level and applied to new situations. For instance, the chemical bond is presented in the first unit as the result of attractive forces that hold the atoms in molecules together; in unit two: valence shell, ionic and covalent bonds, bond energy and hydrogen bonding are presented; in the third unit, we present the properties of ionic and covalent compounds; and in the fourth the molecular structure.

Complementary concepts are studied to help the construction of the basic concepts listed above, and to understand the properties of the substances with which the learners work.

Moreover, chemical analysis and synthesis are presented as major tools to obtain the chemical knowledge of nature and as an example of scientific methodology.

The program has four units. In the first semester we study "Water: origin and source of life" and "Air: the gaseous ocean we live in". "Soil: basic resource for food supply" and "Chemistry in development" corresponds to the second semester. We selected the subjects of the first three units thinking that all the students will have some questions about those important life substances.

The study of water, air and soil provides a context for learning the basic concepts of chemistry and for appreciating the relation between chemical knowledge and technology. "Chemistry in develop-

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ment" shows some lines of research important to the development of this science and to our country; it provides the opportunity to synthesize the concepts and methodology that are used throughout the courses.

As an example we will discuss how we present the unit related to water and one of the lines of research of "Chemistry in development".

We introduce the unit asking the students why water is important at home, in industry, for living matter and as a climate regulator. Generally, the students' answers concern the importance of water to life and for domestic uses, but they cannot relate these uses to the properties of water. Then, we start a learning cycle about other uses of water and its properties to establish the relation between the uses of this substance and its properties.

The properties studied are heat capacity, solubility, melting and boiling points and density. For their importance in water uses, we give special attention to solubility and heat capacity.

In this way, it is possible for the students to explain why water has so many uses and to relate these uses to the properties of water. At the same time, they learn about mixtures, solutions, electrolytes, the stability of water molecules and the water molecular model.

Water pollution is also discussed, with the aim of helping the students better understand their responsibility, as a part of society, to protect the environment and to use rationally the natural resources.

Water properties are compared with properties of other substances to establish that water is a special compound. By another inquiry process, the students try to answer why water has unique properties.

In this part, the outstanding features of the decomposition and synthesis of water are pointed out.

Energetic and chemical changes are emphasized to enhance the knowledge of chemical structure and bonding of matter. The properties of oxygen and hydrogen are reviewed as well. The units on air and soil are presented in a like manner.

As previously mentioned, in the unit "Chemistry in development" some lines of research are presented as a means of showing the students the way of scientific development in the field of chemistry to help them understand the interrelations of science-technology-society.

One of these lines of research is related to the development of new medicines, which is called "Ancient remedies. New drugs". It presents some contributions of chemistry to the improvement of human health, simple cases of the relationship between structure and biological activity, and other findings related to the prevention of diseases such as AIDS.

The extraction of active components from natural materials, structure determination, synthesis, pharmacology and medical formulation are presented as an example of how chemists work to develop new drugs.

In this way, throughout the courses, the relationship among science, technology and society illustrate:

- science as a social product and in constant development;
- how chemical knowledge helps to design technological solutions to practical problems;
- the ways in which chemistry develops;
- the ability and responsibility of society, through science and technology, to protect the environment and to promote a rational use of natural resources;
- the influence of social needs on scientific and technological research. ■