



YALE NATIONAL INITIATIVE

to strengthen teaching in public schools®

Curriculum Units by Fellows of the National Initiative
2011 Volume V: Chemistry of Everyday Things

Introduction

by Gary W. Brudvig, Professor of Chemistry and of Molecular Biophysics and Biochemistry

In our everyday lives, we use an incredible number of products that have been developed by the chemical industry. These include everyday things such as plastics, cleaning products, fertilizers, pesticides, electronics, cosmetics and medicines, to name just a few. Just look in the cabinets in your bathroom, under your kitchen sink or near your washing machine where you will find all kinds of chemical products, some quite hazardous, for cleaning, bleaching, polishing, etc. Learning about the Chemistry of Everyday Things is a great way to make science relevant to the social and personal lives of our students. In addition, a greater knowledge of the science underlying the products we use every day can help us to understand how to make better choices for our health and our environment. Our consumer-driven society generates a tremendous amount of waste that is threatening the carrying capacity of Planet Earth. The enormous challenge facing us can be summarized in one word: sustainability. The aim of this seminar was to illustrate how the principles of chemistry relate to products that we use every day and how a consideration of our use and disposal of these products may lead to a more sustainable society.

My own interest in science stems from my hands-on experiences as a child. Therefore, many demonstrations were included in this seminar – at least one demonstration during each seminar meeting. These demonstrations were chosen so that they could actively involve the participants and at the same time illustrate the scientific principles related to the Chemistry of Everyday Things.

The book by Cathy Cobb and Monty L. Fetterolf entitled *The Joy of Chemistry: The Amazing Science of Familiar Things* was used as the primary text for the seminar. During our first meeting in May, we generated a list of topics for discussion during the intensive session in July. These included Personal Care Products, Cleaning Products, Antifreeze and Deicers, Batteries, Hot and Cold Packs, Biofuels, Gunpowder and Fireworks, Refrigeration, and Plastics. Each Fellow then chose one of these topics and prepared a demonstration (or two or sometimes three) related to this topic to present during one of our meetings in July. I also provided some of my own demonstrations. As a result, we had at least one demonstration during every seminar meeting, and sometimes several, that provided a great basis for further discussion. We discussed the chemistry for production and recycling of different types of plastics in some depth. A demonstration on the synthesis of nylon added to these discussions. Our discussion of the chemistry of cleaning products included a great demonstration on making soap. The discussion of antifreeze and deicers was enriched by a demonstration on ice cream, which the Fellows (and seminar leader) made and consumed with enthusiasm. Renewable energy is a key aspect of sustainability. With this in mind, the seminar included a discussion of biofuels and processes for solar energy conversion using artificial photosynthesis. A highlight of the seminar was the production of biodiesel fuel from cooking oil that culminated in the combustion of biodiesel fuel in an oil furnace burner.

The curriculum units developed from this seminar are suitable for elementary to middle-school to high-school

students. In all of the units, the science content is integrated with language arts, mathematics and social studies to provide a balanced program that meets the literacy requirements of the school system. The Fellows have prepared extensive lists of materials that can be used in the classroom or as resources. These materials include books that the children can read, textbooks that the teachers can use, demonstration sourcebooks, suppliers of equipment, useful computer software, and addresses of sites on the World Wide Web. All of the Fellows developed units based on a theme or activity related to everyday things, including an innovative "survival chemistry" unit that illustrates the use of spiraling to reinforce the chemical principles from experiments to prepare pure water and biofuels. Other units are related to the chemistry of hair, cleaning products, batteries, weather, and plastics. The units include a number of excellent activities that will engage the students' interest by connecting to relevant topics and at the same time teach them about chemistry and sustainability.

I would encourage all teachers of elementary through high school students to review these curriculum units. These materials provide a valuable resource for incorporating topics of science and society related to the "Chemistry of Everyday Things" into the classroom.

Gary W. Brudvig

<https://teachers.yale.edu>

©2023 by the Yale-New Haven Teachers Institute, Yale University, All Rights Reserved. Yale National Initiative®, Yale-New Haven Teachers Institute®, On Common Ground®, and League of Teachers Institutes® are registered trademarks of Yale University.

For terms of use visit https://teachers.yale.edu/terms_of_use