REVIEWS

Noggle's text includes many worked-out example problems and sensible problems at the end of each chapter, with answers at the end of the book.

I consider that Noggle's second edition is one of the best texts for undergraduate physical chemistry. I also suggest that this book may be especially appropriate for courses in physical chemistry in which the majority of students will not become professional physical chemists. This last statement is *not* intended to imply that this book is too "weak" to provide a good background for the small fraction of important students who will become physical chemists.

Loren G. Hepler
University of Alberta
Edmonton, AB, Canada T6G 2G2

The World of Chemistry

Roald Hoffmann. The Annenberg/CPB Project, distributed by Intellimation, P.O. Box 1922, Santa Barbara, CA 93116-1922. For preview and ordering information call toll-free 1-800-LEARNER. COMPONENTS: 13 1-h VHS videocassettes (26 28-min. programs; 2 programs per cassette) available now. Textbook, study guide, laboratory manual, and teacher's guide will be published by Saunders College Publishing in the autumn of 1990. The programs will premiere as a series on PBS and cable channels in September 1990.

Summary Rating: Category	
Ease of Use:	Good
Subject Matter Content:	Good
Pedagogic Value	Excellent
Student Reaction:	Excellent

A rampant epidemic of chemophobia—an irrational fear of chemistry and chemicals—, aided and abetted by "scare of the week" stories in the media, is currently sweeping the country, resulting in higher costs, reduced productivity, more burdensome regulations and laws, less research, and fewer new chemical products. Although the problem is a complex one, not amenable to any one solution, educating the general public about the goals, motivations, and methods of chemists; the concept of risk versus benefit assessment; and the multifaceted contributions of chemistry to our society should go a long way toward ameliorating the situation. This important new television-based course deals with these ideas in a masterful fashion and should help to combat chemophobia among its viewers—nonscience majors at two-year and four-year colleges, who, as voters and citizens in a democracy, will be called upon to participate in deciding upon a variety of scientific and technological issues.

The course may be taken for credit from participating colleges or from the University of Wisconsin Extension Service but will reach an even wider general audience among the public at large. It should provide both distant learners and campus-based students with a comprehensive educational package and should furnish chemistry professors with a sound and flexible system of quality instructional resources that may be used *in toto* or as a supplement to traditional college courses. Co-directed by Isidore Adler of the University of Maryland at College Park and Nava Ben-Zvi of the Hebrew University of Jerusalem and the Open University of Israel, aided by a 14-person board of advisors, the series was produced by the Educational Film Center, Annandale, Virginia with television producer Richard Thomas as executive producer. Major funding was provided by the Annenberg/CPB Project, with additional funding from the Dow Chemical Company, Eastman Kodak, the Exxon Educational Foundation, E.I. du Pont de Nemours and Company, Johnson Wax, PPG Industries Foundation, the Council for Chemical Research, Monsanto Company, and the American Chemical Society.

The series host, Roald Hoffmann of Woodward-Hoffmann rules fame, John A. Newman Professor of Physical Science at Cornell University and a published poet (*The Metamict State*, 1987, and *Gaps and Verges*, scheduled for 1990 publication), shared the 1981 Nobel Prize in Chemistry with Kyoto University physics professor Kenichi Fukui and recently received the American Chemical Society's highest honor, the Priestley Medal, for 1990. A fervent exponent of communicating an appreciation of the beauty and importance of chemistry to the public, he spends half his time teaching general chemistry and thus is an ideal host for the series. The series demonstrator, Donald Showalter, Professor of Chemistry at the University of Wisconsin at Stevens Point, appears in all the programs except for two (Nos. 1 and 23), and he performs familiar perennial favorites as well as unusual, unfamiliar demonstrations. Fifty distinguished scientists from industry, government, and academe share their views on topics dealt with in the course. Three Nobel laureates—Christian B. Afinsen (optical acitivity), Linus C. Pauling (structure of proteins), and Glenn T. Seaborg (the actinide hypothesis)—are included among the guests on the series.

The programs provide a unified view of chemistry, featuring principles, facts, and theories which are revealed through practical applications, computer graphic illustrations, and experimental demonstrations. Most of the programs begin with a series of questions which are answered in depth in the course of the program. Except for the first and last programs, which consist largely of statements by guest scientists, the presentation is eminently visual and filled with lots of action and moving images.

The historical foundations of chemistry are strongly emphasized; William Henry Perkin's serendipitous discovery of mauve, the first of the synthetic aniline dyes, and Sir Ernest Rutherford's alpha-particle scattering experiment are recreated as demonstrations or computer graphic simulations; classic serendipitous discoveries such as Friedrich Wöhler's synthesis of artificial urea and Louis Pasteur's resolution of sodium ammonium tartrate are discussed, and a 5000-year-old tablet dealing with a dispute on weights and measures is shown. Except for programs 1, 2, 24, 25, and 26, a review summarizing the main points is included near the end of each program. Although the programs are most effective when seen in the prescribed sequence (Hoffmann links programs 3, 5, 6, 8, 9, 13, and 25 to the next or preceding programs by his remarks), each may also be viewed independently. The participants project their enthusiasm for chemistry, but they freely admit its limitations and past mistakes, especially in dealing with the environmental effects of chemical products.

The titles and brief contents of the programs give some idea of the wide scope of the series—(1) "The World of Chemistry" (an introduction to chemistry and the series); (2) "Color" (the role of colors and dyes and how color helps chemists study the molecular world); (3) "Measurement: The Foundation of Chemistry" (why accurate and precise measurements are crucial); (4) "Modeling the Unseen" (how scientists explain behavior at the submicroscopic level); (5) "A Matter of State" (properties of solids, liquids, and gases); (6) "The Atom" (from ancient to modern views); (7) "The Periodic Table" ("the most important piece of equipment that you're likely to encounter in a chemical laboratory"); (8) "Chemical Bonds" (the nature of the interatomic glue holding our world together); (9) "Molecular Architecture" (how molecules are formed from atoms and how their shapes affect their properties); (10) "Signals from Within" (how chemists use the interaction of energy with matter to determine the nature and behavior of substances); (11) "The Mole" (chemical change from a quantitative point of view); (12) "Water" ("the strangest chemical of all"); (13) "The Driving Forces" (why chemical reactions occur and the factors governing their rates); (14) "Molecules in Action" (chemical reactions and the role of catalysts); (15) "The Busy Electron" (redox reactions in electrochemical cells, batteries, electrolysis, and corrosion); (16) "The Proton in Chemistry" (acids, bases, and pH in the laboratory and natural systems); (17) "The Precious Envelope" (the chemistry of the earth's atmosphere and how human activities affect its future); (18) "The Chemistry of the Earth" (distribution of mineral resources); (19) "Metals" (their special properties and how they are manipulated); (20) "On the Surface" (how surfaces differ from the bulk of substances); (21) "Carbon" (organic chemistry and synthesis of organic substances); (22) "The Age of Polymers" (how industrial chemists convert oil and natural gas into thousands of synthetic materials); (23) "Proteins: Structure and Function" (biopolymers of amino acids and their role in the processes of life); (24) "The Genetic Code" (how the body manufactures life-sustaining proteins and how they are passed through generations); (25) "Chemistry and the Environment" (the challenges that chemicals and chemical waste present to chemists and society; risks, benefits, problems, and solutions); and (26) "Futures" (academic and industrial scientists discuss future trends).

The only errors that I found in the series are admittedly minor; the periodic table was discovered 120 years ago not 100 years ago (program 7); although Charles Martin Hall's

patents for the electrolytic production of aluminum were not issued until April 2, 1889, his famous discovery occurred on February 23, 1886 (program 19); and Pasteur's mechanical resolution involved sodium ammonium racemate not the free acid (program 9).

Hoffmann and his collaborators have admirably succeeded in their goals of delineating chemistry as a human activity motivated by curiosity and in demonstrating its relevance to modern life. I warmly recommend their series not only to college students and their instructors but also to anyone curious about the basic principles of "the central science" and its role in our society.

George B. Kauffman
California State University, Fresno
Fresno, CA 93740

Drinking Water Health Advisory: Pesticides

United States Environmental Protection Agency Office of Drinking Water Health Advisories. Lewis Publishers: Chelsea, MI, 1989. xiv + 819 pp. 16 × 24 cm. $79.95.

In these days of rising and often misdirected public concern about synthetic chemicals in water supplies and foodstuffs, chemistry teachers are likely targets of questions about the pesticides and herbicides in common use. Here is an authoritative, conveniently collected set of status reports on 50 compounds with potential for causing adverse health effects in exposed humans. These are substances that already have been found in drinking water or are likely candidates for such contamination.

The materials are listed alphabetically by generic names with CAS No., structural formula, synonyms, uses, properties, environmental fate, pharmokinetics, health effects, analytical methods, and treatment technologies.

The book would better serve the needs of novitiates if there were an index of the synonyms. Not all of us remember that Sevin, a pesticide widely used in family gardens, also is *carbaryl*, the identification in this Health Advisory. This omission may retard quick searching of the book, but it doesn't lessen the great value of the provided information once it is located.

Malcolm M. Renfrew
University of Idaho
Moscow, ID 83843

My Life in the Golden Age of America

Malcolm Dole. Vantage Press: New York, NY, 1989. ix + 207 pp. Photographs. 14 × 21 cm. $14.95

This author is a good storyteller and provides a thoroughly interesting report on the chemistry he learned at Harvard and what he had to learn elsewhere in experiences around the world that early on took him to Peter Debye's laboratory in Leipzig. His own professional development mirrors the rise of graduate education in our field over 60 years in which he became an important contributor with early textbooks on statistical thermodynamics and electrochemistry. He rose through the academic ranks at Northwestern University, retiring from there to become Robert A. Welch Emeritus Professor of Chemistry at Baylor University. More recently, he has been a distinguished member of the Santa Clara Valley ACS section and has served as a consultant for laboratories in that area.

Dole departed from the academic scene to take part in the Manhattan Project during the war years. His research interest in polymer chemistry, especially in radiation effects, led to industrial consultantships with commercial application of his basic findings. He also takes pride in his experimental detection of differences in the atomic weights of oxygen in air and water that led to the change in the atomic weight scale now based on $_{12}C$ rather than oxygen.

Among the many cheerful anecdotes is Dole's pursuit on his bicycle of a young man who had lifted his wallet from a hip pocket. Recovery of the wallet led to national news coverage. In Waco the local paper headlined "Baylor Chemistry Professor Dissolves Robbery Attempt"; elsewhere thieves were warned not to mess around with Dole.

Chemistry teachers and their students will gain educational values from this book scientifically. It also will serve as a worthy model for clarity in composition.

Malcolm M. Renfrew
University of Idaho
Moscow, ID 83843

The Art and Science of Lecture Demonstration

Charles Taylor. Adam Hilger: Bristol, England; Philadelphia, PA, 1988. xiv + 188 pp. Figs. 13.8 × 21.5 cm. $13.95 paper.

When former students visit me, the parts of my lectures that they invariably recall most vividly are my lecture demonstrations, usually the more spectacular ones, even though in some cases more than three decades have elapsed. Indeed, the "live" lecture demonstration is a most effective means of communication, even in this era of film, television, and other varieties of "canned" media. According to Charles Taylor, Professor of Experimental Physics at London's Royal Institution and Emeritus Professor of Physics at the University College, Cardiff, Wales, "It seems to work with all age groups and is a great way of inculcating a sense of excitement about science, especially in children".

In 1985 the Royal Society established a special commission to study the problem of increasing the public's understanding of science, a problem which has been discussed and debated widely in the wake of the rampant epidemic of chemophobia that is sweeping the United States and other developed countries. In the committee's report (*The Public Understanding of Science;* The Royal Society: London, 1985) the scientific establishment of the United Kingdom gave full approval to the presentation of lecture demonstrations to juvenile audiences and provided the impetus for Taylor's latest book, which incorporates the substance of the Gregynog Lectures that he delivered at the University College of Wales, Aberystwyth during 1987–1988.

In the "Prologue" Taylor states, "My principal purpose [in writing this book] is to encourage teachers and lecturers once again to consider the technique [of lecture demonstration, the use of which has lately experienced a decline] seriously and to take the time and trouble to illustrate their lessons and lectures. Since I am a physicist I have confined my illustrations to physics, but most of the principles discussed apply equally well whatever branch of science is being taught."

Like Gaul, Taylor's volume is divided into three parts. Part 1, "The Growth of the Art" (47 pp), examines the history of demonstrations from the time of Pythagoras to the present day, with details of some of the famous demonstrations of the past (by John Tyndall, John Theophilus Desaguliers, Thomas Young, Sir Humphry Davy, Michael Faraday, Sir James Dewar, Hermann von Helmholtz, D. C. Miller, Sir W. Lawrence Bragg, etc., who are limned in biographical sketches) that can still be used very effectively. It also includes several examples of more recent demonstrations, including those on television. Part 2, "The Science behind the Art" (38 pp.), considers in detail the problems of transferring information from the lecturer to the audience (the psychology of lecturer–audience interactions). It also surveys various types of teaching aids which may compete with or complement demonstrations (slides, tape-slide combinations, closed-circuit television, video recording, video discs, and microcomputers) and deals with the most useful methods for integrating these techniques into a demonstration lecture. Part 3, "The Practice of the Art" (68 pp), the longest part of the book, deals with the crucial, practical details of presenting a successful demonstration lecture such as hints on how to get started, care in presentation, choosing the correct apparatus size, coping with disasters, taking a lecture on tour, how to keep the attention of an audience varying in age from 7 to 70, audience participation, and safety. This copiously illustrated book is replete with photographs or drawings of historical equipment and manuscript notes.

The "Epilogue" (4 pp) discusses the future of the lecture demonstration and the all-important need to increase the public understanding of science and technology. A list of references (3 pp), dating from 1709 to 1987; an index of demonstrations (3 pp, 58 demonstrations), classified as "visual aids using nonconventional apparatus," "analogue demonstrations," and "real experiments;" and a name and subject index (5 pp) conclude this lucid, entertaining, highly recommended, and most attractively priced collection of reminiscences, advice, recipes, and experiences by "a master of the lecture demonstration," as 1967 Nobel chemistry laureate Sir George Porter calls the author in his foreword.

During the last few years a number of books of lecture demonstrations have appeared, of which I have reviewed the following: Shakhashiri, Vols. 1, 2, & 3, *J. Chem. Educ.* **1985,** *62,* A31; **1986,** *63,* A209; **1990,** *67,* in press. Summerlin & Ealy, Vols. 1 & 2,

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