Physical chemistry texts

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A Textbook of Physical Chemistry. Second edition. By Arthur W. Adamson. Pp.953. (Academic: New York, 1979.) $22.95. *Physical Chemistry.* Fifth edition. By Robert A. Alberty and Farrington Daniels. Pp.682. (Wiley: New York, 1979.) $19.50. *Physical Chemistry: A Step-by-Step Approach.* By Marwin K. Kemp. Pp.1034. (Marcel Dekker: New York, 1979.) $23.75.

IN *A Textbook of Physical Chemistry* Adamson has put some new twists into the traditional format of physical chemistry texts. The ordering of topics, for instance, is significantly altered; a chapter on additive physical properties of matter appears near the beginning of the book. This chapter covers absorption of light, molar refraction, molar polarisation, and dipole moments. These topics would normally be found much later, after discussions of molecular structure. Another novelty is the placement of statistical mechanics in this text. Rather than devote a separate chapter to this topic Adamson includes discussions of statistical mechanics in chapters on thermodynamics. This makes the link between statistical mechanics and thermodynamics more apparent than in many texts.

Other non-standard features of this text include 'Commentary and Notes' and 'Special Topics' sections at the end of each chapter. These contain expansions of topics covered in the chapter, discussions of historical points of interest, and brief discussions of related topics. Unfortunately, some of these sections discuss material much more advanced than material covered in the related chapter. Also, many of the 'Special Topics' are topics normally discussed in physical chemistry texts. Here they are merely added at the end of chapters rather than integrated into the main text.

Overall, this book is a rigorous, rather sophisticated text that would make a fine reference source. It has a fine index and many good figures which help clarify the text. As a book to introduce students to the subject of physical chemistry, however, it seems too sophisticated. Many discussions are too advanced and the ordering of topics sometimes makes the material difficult to understand. There are many problems for students to solve, separated into sections of straightforward exercises, demanding problems, and special topics problems. These are fine learning tools for students. For all but the most sophisticated student, however, the main text will probably be difficult to follow.

Physical Chemistry, by R.A. Alberty and F. Daniels, is a rather traditional textbook for a year-long physical chemistry course. It presents little history behind the subject areas or motivation for studying them. Instead, the emphasis seems to be on presenting formulae to be used in a physical chemistry course. This may be reasonable for use in a course based on a lecture format where the instructor provides background and motivation. This approach leads, however, to a rather dry text. Consistent with this format of a text to supplement lectures, the book presents many problems and answers to about half of them. This is probably the strongest feature of the book from the instructor viewpoint.

Treatments of various topics in the book vary greatly. Many topics are presented too tersely, making it seem that learning facts and formulae is more important than understanding underlying principles. This seems particularly true of the coverage of quantum theory and, to a lesser extent, of thermodynamics. Later sections covering Statistical Mechanics and Kinetics, however, are quite well done.

Some topics covered in this book, such as equilibrium for biochemical reactions, macromolecules, and surface thermodynamics, are not found in most textbooks of physical chemistry. They add a very nice supplement to the traditional topics found in most texts. On the other hand, these chapters again tend to emphasise facts rather than present a general overview of these special topics.

In all, this book would be useful in courses where lectures provide the primary source of fundamental material. It does not, however, stand on its own as a primary learning tool for physical chemistry.

Physical Chemistry: A Step-by-Step Approach, by M.K. Kemp, differs from other physical chemistry texts in that it is designed for use in a self paced (sometimes called 'Keller Plan' or personalised system of instruction) course. In such a course there are often no lectures and the book becomes the primary source of information for students. Thus, the book must be very clear. This book is just that.

Each topic in the book is introduced with a statement of the importance of understanding the topic as well as a list of learning objectives the student must keep in mind. After discussion of each topic there are problems, with detailed solutions given in an appendix, and a self test. A detailed table of contents and a list of symbols and definitions also precede each topic to aid the student.

This book has very few weak points. There are not as many problems as one might wish and the introduction to quantum theory is weak. However, later sections on atomic structure and spectroscopy are excellent. Most topics are introduced at a very elementary level and progress through to a rather high level of sophistication. Treatments of real gases, colloid and surface chemistry, and polymers are particularly thorough.

In all, this is an outstanding text for physical chemistry courses using a self paced format or a standard lecture format. *Physical Chemistry,* by P.W. Atkins (Freeman: San Francisco, 1978), is the only other physical chemistry text this reviewer has seen which matches this book in clarity of presentation. □

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Physical chemistry for the life sciences

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Physical Chemistry with Applications to the Life Sciences. By David Eisenberg and Donald Crothers. Pp.868. (Benjamin Cummings: Menlo Park, California, 1979.) $21.95.

THIS book surpasses all other life science-orientated physical chemistry texts I have examined in both the extent and depth of its coverage of traditional physical chemistry topics. Thermodynamics, solutions, electrochemistry, statistical mechanics and X-ray structure analysis are all presented at about the same conceptual and mathematical level as found in standard 'for chemists' texts, such as the most recent edition of *Physical Chemistry* by Moore (Prentice-Hall: Englewood Cliffs, New Jersey, 1972). This is not to say it could replace a text like Moore's in a traditional two-semester 'for chemists' course. Its treatment of atomic structure and chemical bonding is neither extensive nor rigorous enough, and it has little to say about gas properties, kinetic molecular theory or reactions in the gas phase.

This text also has much to offer in the way of biological applications. Along with the usual topics (enzyme kinetics, transport properties, membrane equilibria, bioenergetics) it provides a more extensive treatment of macromolecular biophysics, including DNA characterisation, than any of the competing texts I know of, and it contains a lengthy qualitative section on the application of symmetry to the description of biological systems. Another attractive feature is that many of the mathematical results derived in the text are accompanied by a verbal description of their physical significance, and in most instances the explanations successfully illuminate the equations.

I was disappointed to find that several important biochemical topics normally included in a text of this kind were omitted by Eisenberg and Crothers. Aside from a paragraph on transition-state analogues, there is no discussion of enzyme inhibition, and there is nothing in the way of photochemistry or photobiology apart from a passing reference to photosynthesis. I also feel that the text needs more illustrations, and many that are present are too small or too sketchy. In reading the sections on membrane phenomena, for example, I missed not seeing a picture of the modern model of a biological membrane, and the illustration accompanying the discussion of the hydrophobic effect did not help me at all in envisioning 'icebergs'. My most serious concern is that some of the major topics are developed in an unnecessarily formal manner. The reader has to labour through an entire chapter on principles of spectroscopy, and several sections of the ensuing chapter, before encountering illustrative chemical examples.

Overall, the book's good points outweigh its shortcomings. You will want to give it serious consideration if you are seeking a text that offers life science students a solid foundation in physical chemistry. □

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Biology from a human angle

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Inquiry into Life. Second edition. By Sylvia S. Mader. Pp.771 plus appendix, glossary, index. (Wm. Brown: Dubuque, Iowa, 1979.) $15.95. *Biology. Human Perspectives.* By Charles Kingsley Levy. Pp.562. (Goodyear: Santa Monica, California, 1979.) $17.95. *Man, Nature and Society. An Introduction to Biology.* Second edition. By E. Peter Volepe. Pp.662. (Wm. Brown: Dubuque, Iowa, 1979.) $15.95. *Biology. A Human Approach.* Second edition. By I.W. and V.G. Sherman. Pp.636. (Oxford University Press: 1979.) $16.95.

ALL four of these books aim to introduce biology to students beginning a college education. It must be assumed that such students have no background at all and instruction must begin with the most basic and general aspects of biology. The field is notable, even to one who works in it, as short on theories and general organism principles and long on variety. The broad problems of life — maintenance, regulation and reproduction — are approached in a bewildering diversity of forms and treated in many different ways by living organisms. How does an instructor construct an introductory course from such diverse material? The books under discussion do so by concentrating on the biology of a single species, humans, discussing important generalities in terms of human examples and then continuing with discussion of specific problems or processes peculiar to the species and its relatives. Around 98% of all organisms are excluded by this approach.

The reasons for concentrating on the biology of a single species are variously stated by the authors. Mader's book, *Inquiry into Life*, "emphasizes the application of this knowledge to modern concerns . . . biology is truly relevant." *Biology. Human Perspectives* by Levy aims to avoid fragmentation and to concentrate on the biology of the most intensively studied organism. He, too, feels that this biology will have the greatest "appeal, relevance and interest . . ." for students, busy enquiring humans that they are. Volpe in *Man, Nature and Society. An Introduction to Biology*, wishes to educate liberally, to present biology so that intelligent use can be made of it by humans who, though not extensively trained in science, can recognise the importance of biology in many social and ethical problems in society and can approach such problems thoughtfully and rationally. The Shermans in *Biology. A Human Approach* similarly hope to present information that will enable students "to understand themselves and the world in which they live." They, too, consider personal relevance and "areas of immediate human concern" important to their presentation. All the books, then, wish to show us biology epitomised in ourselves and as affecting us in the world today.

The four books, though attempting more or less the same feat, do not approach the subject with the same intellectual views, principles of organisation or physical orientation. Also, they do not seem intended for the same students. The intellectual level of the texts varies greatly, as does the emphasis on the material presented.

Before commenting specifically, I ought to note my own prejudices. First, I am not sure that the human organism is so interesting or so dominant that it is worth an entire general biology book. Many humans think otherwise; three of the texts considered here are in second editions. Second, to my mind, the only truly integrating approach to general biology is an evolutionary and genetic approach. Without this, texts fragment into sections not easily connected to one another. The first and second prejudices reinforce each other. Third, I have been teaching a general biology course, using several different texts, over the past eight years. My reactions to new texts are dulled, rather than heightened by the experience.

Of the four books, by far the most interesting, easy to read and best organised was Volpe's. Rather than begin with a discussion of 'life' and its origins, or with a long section on chemistry, Volpe begins with a discussion of human reproduction, nicely balanced between endocrinology and anatomy. This is followed by an outstanding chapter on the control of fertility in humans which in turn is followed by a clear descriptive discussion of vertebrate development and birth. A clever transition is then made to consideration of the biochemistry needed for modern biology by considering the problem of trans-placental transfer of nutrients. We then return to cell differentiation and development. The section is concluded with seven clearly written chapters on physiology and endocrinology of adults. Two sections follow on genetics, evolution and population genetics. These constitute nearly half the material in the book and take the student from the chemical basis of inheritance via biochemical genetics and simple population genetic studies of selection and evolution, to questions of polygenic inheritance, speciation and adaptive radiation. The concluding section covers other aspects of populations and biological communities. Appendices on simple chemistry and on probability follow the body of the text. Throughout the writing is clear; transitions between subjects are deftly made, and the material is accurately presented. The standard of illustration is high; both colour photographs and coloured full page drawings are used in addition to smaller black and white photographs and drawings. I regret only that this text, like most others in the field, does not supply scales to each picture. Biology deals with structures over at least a millionfold size range. Certainly, beginners ought to be helped to some sense of scale. Volpe's book is directed at intelligent beginners. It is first rate overall and should stimulate both students and teachers using it.

The three other texts considered here are rather more like each other than not. Sherman and Sherman and Levy present material in a traditional manner, emphasising physiology and structures far more than genetics and evolution, though the latter subjects do make an appearance. The Shermans' book is clearly written, though the use of boldface to introduce important words and phases makes the text rather shout at the reader. I concede that students in this country often apply liberal amounts of yellow highlighting to achieve