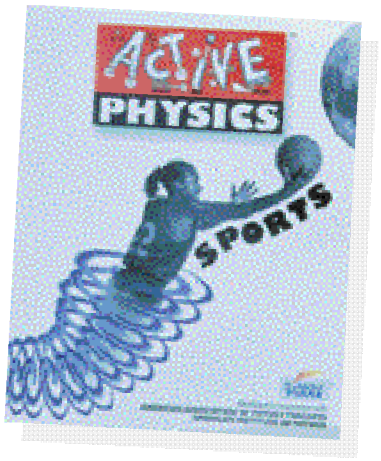
Survey of High-School Physics Texts

Active Physics



Active Physics,

Author: Arthur Eisenkraft

Publisher: It's About Time, 84 Business Park Drive, Armonk, NY 10504; copyright 1998

Cost: Each module: $14.95 softcover; $18.95 hardcover; plus videos and software

Physical Characteristics: Six volumes of text, each between 115 and 175 pages; Volume topics are Communications, Home, Medicine, Predictions, Sports, Transportation

Peripherals: Teacher's guide; spreadsheet software (used with Predictions, Sports, Transportation); videos (to be used with Communication, Sports, Transportation, Medicine); six professional-development videos

Intended Audience: 9th through 12th grade students with minimal math skills who are more likely to be motivated by laboratory investigations than by intellectual puzzles

Reading Level: 9th through 12th grades

Math Level: There are no derivations; occasionally equations support assertions, but are not incorporated into several-step logical processes; fairly rarely students are asked to use such equations to solve one-step problems; very few in-chapter sample problems exist.

Content Distribution: Each of the six volumes has several chapters, is self-contained, and has an index. Each chapter includes some or all of these sections:

1) *Scenario* – A description of a problem situation that the students are to resolve.
2) *Challenge* – A specific statement of what a satisfactory resolution would look like.
3) *Criteria* – An explicit statement describing how student work is to be evaluated.
4) *What Do You Think?* – Students are encouraged to state, before studying the unit, what they know or believe that might be relevant to the situation.
5) *For You To Do* – These are assignments, mostly laboratory-type activities, and often to be done by groups of students.
6) *Physics Talk* – Definitions of technical terms and discussions of physics concepts.
7) *For You To Read* – Text discussions of topics related to the physics concepts under study.
8) *Reflecting on the Activity and Challenge* – An effort to help students relate the results of activities to the student goal of meeting the challenge.
9) *Physics To Go* – Additional assignments in the form of questions and problems. Could be used for homework.
10) *Inquiry Investigation* – Suggestions for ways students could design extensions to their laboratory work.
11) *Stretching Exercises* – Fairly challenging activities, thought problems, and lab work. Designed for students who are especially able and eager.
12) *Chapter Assessment* – An opportunity for students to assess how well they met the challenge.
13) *Physics You Have Learned* – A list of ideas and facts discussed in the preceding unit.
14) *Physics at Work* – Profile of a person who makes a living using knowledge related to the physics just treated.

Special Features: The layout is attractive and liberally sprinkled with drawings and pictures. A large percentage of the drawings are intended to be humorous. The volumes are thematic, and not all topics treated in traditional high-school texts are covered, nor are they given in the usual progression from elementary to more complex. Concepts from mechanics appear in all six volumes, but students who take courses that use only three or four of the volumes will miss some concepts. The positive side of this is that students will be motivated to master those topics included because they need the information to be successful in meeting their challenge. Numerical homework problems require only one-step calculation. There are many questions, some of which can be answered by simple recall; the majority require one-step or multiple-step conceptual processes, and some are quite challenging.

Much of this text is devoted to describing required lab

activities. The teacher's editions contain a few suggestions for demonstrations, but the main thrust of the course is to keep the students active, carrying out plausible, if not everyday, tasks. A few suggestions are included about how to use a graphing calculator, but this kind of activity is not built into the course in a serious way.

The volumes are carefully designed to be race and gender neutral. Names of famous contributors to physics are occasionally mentioned, but no space is devoted to placing advances in scientific thought in a historical context. Students who master the ideas introduced in this course will meet many of the National Science Education Standards.

Alternative Assessment: Students are encouraged to self-assess their progress. There is no effort to help teachers measure learning.

General Comments

We take the goals of *Active Physics* to be these:

1) To present physics in such an attractive package that students for whom science is not a major interest will be motivated to participate enthusiastically in the learning activities described.
2) To involve students in learning tasks that can be performed successfully, even by those who do not normally experience academic success and who have not yet developed high-level mathematical skills.
3) To include in the course a sampling of physics concepts and to embed these in a variety of contexts so that the students will recognize the power of the methods used by scientists to acquire knowledge and to apply knowledge to the solution of everyday problems.

In our view, the format of the text and the pedagogical approach used has taken the author several strides toward achieving the first two goals. Success in achieving goal three is more problematical. Teachers often disagree about which topics are essential to a good high-school course and which ones can be safely omitted. However, so many topics traditionally included in high-school physics courses are omitted from this one—or might be omitted if all six volumes are not used—that many teachers will choose not to adopt it. While we feel that courses that focus on a small number of topics can be very successful, the criterion for inclusion should be the richness of the topic in illustrating concepts of wide generality rather than the relevance of the topic to the solution of applied problems. As an example, we believe more effort to illustrate the power and generality of the conservation-of-energy principle in this text would have been preferable to the detailed treatment of sound level that was included because of its relevance to deafness.

Do the topics treated appear in a variety of contexts? The answer is mixed. The concepts "speed" and "force" appear in every volume, and the way they are used varies widely. On the other hand, concepts related to heat and thermodynamics appear only in the Home volume, and only in the narrow context of solar energy.

How well all three goals are realized is influenced strongly by scientific accuracy. There are a few mistakes in this text, but not more than found in other texts. For a first edition, it is pleasingly mistake free. However, we do fault the author's judgment at numerous places in the text regarding the depth of treatment that is appropriate. For example, more space is devoted to the yellow traffic light problem than its importance warrants. In contrast, the use of conservation principles—energy and momentum—in analyzing elastic collisions is given short shrift.

Most experienced teachers agree that students learn best by doing experiments, not by listening to lectures, and therefore will applaud the emphasis on student activity. However, many teachers see great value in problem solving, yet this activity has a low profile in this text. We believe that more numerical work, in the form of making and interpreting graphs, for example, could have been included without creating insurmountable barriers; the course would be stronger if this had been done.

Summary

Physics teachers who want to serve a nontraditional clientele and who are willing to use laboratory activities extensively will view this as a workable—but at this time, still an experimental—text. Students who enroll in a course that uses this text will enjoy it, will succeed with most of the challenges it presents, and will learn some physics in the process.

The author will receive many criticisms from reviewers and users. He will make revisions, and if these are attentive to the need for more care in selecting topics to treat, better judgment concerning the depth of treatment, and a greater appreciation of the value of numerical problem solving, the second edition will be more widely used and more successful in meeting all its goals.