***Physics: The First Science,*** by Peter Lindenfeld and Suzanne White Brahmia, Rutgers University Press (New Brunswick, NJ), 2011; xv + 367 pp., $72.00 paperback, ISBN 978-0-8135-4937-8.

This algebra-based introductory physics text criticizes other introductory physics texts for being encyclopedic and dry, and presenting "exercises with little relation to the real world." Its authors have set as their goal to take "a different approach by offering uniquely accessible, student-friendly explanations, historical and philosophical perspectives, and mathematics in easy-to-comprehend dialogue . . . with features to help students see the physics in their lives."

I feel that, by and large, they have achieved their goal—and in little more than a third of the number of pages used by their competitors. And they didn't do it by omitting topics or watering down the math. They add vectors and use trigonometry to describe their components. While the text is designed to be used by those not familiar with calculus, the ideas of derivative and integral are introduced in a user-friendly way, which enables the authors even to motivate the Schrödinger equation, with sine functions for free particles, further generalized to include a potential energy expression.

The authors have achieved their goal by making every part of their book count, using a two-column format with little margin. The worked-out examples in the text should be read as part of the text and not regarded as optional. Every chapter concludes with a summary, guided review, problems and reasoning skill building, multiple-choice questions, and synthesis problems and projects. Many of the exercises refer students to work with PhETs.

All the topics expected in an introductory physics course are included, but they are woven together with a storyline that provides the "student-friendly explanations," beginning with an introductory chapter that portrays the range of structures in the universe in terms of spatial extent, scale of energy, and predominant forces. When they begin kinematics, which is motivated by both motion diagrams and graphs of position and velocity versus time, the authors point out that they will be neglecting the internal structure of objects to model them as points. Later, after encountering internal energy (primarily kinetic energy of molecules) resulting from dissipative forces, they embellish the model with the kinetic theory of gases. But even here, with the molecular kinetic energies dwarfed by molecular excitation energies, the internal structure of the molecules is still neglected.

Before getting into the subject of energy ("there is hardly a concept more pervasive . . . in all of science"), though, the authors pause after kinematics and dynamics to examine the role of theories and laws and to evaluate the model of classical mechanics. And with all the fundamental forces already presented in the first chapter, this enables the classical mechanics model to be extended to include all of classical physics, in particular the role of the electric force, which "determines almost everything that we are aware of, including our very existence, and that of everything around us," although we are largely unaware of it because the strength with which protons attract electrons makes most matter neutral.

A topic that plays an important role in this book is quantum physics, in which the authors adopt the position that fields are the ultimate reality, developing this concept on the basis of Maxwell's theory of electromagnetic radiation in the preceding chapter on waves and their earlier discussion of Gauss' law for electric fields. But mindful of the need to present physics as something relevant to our lives, they follow up their chapter on quantum physics per se with a penultimate chapter, "Atomic Physics Pays Off," which shows how quantum mechanics has enabled us to understand the structure of matter and the conduction of electricity through it, something that has enabled the wide variety of entertainment and communications devices we use today.

Another example of the relevance of physics in our lives presented by this book is the role of energy. In addition to a chapter presenting the forms of energy (including electric potential) and their governance by the first law of thermodynamics, the authors also include a chapter on "Energy in Civilization," in which they remind us that the role of energy in our society is limited by the laws of thermodynamics. We can only transform energy we can access, and some of what we transform ends up as waste. Accessing energy from fossil fuels is now limited by the prospect of climate change. Except for geothermal heating and liquid fuels from biomass, transforming other sources of energy leads to electric energy, which must be stored unless it is used right away, hence the need to reduce the stored energy/mass ratio of batteries. We are now engaged, they add, in an experiment to determine whether we can control our population and our lifestyle to live sustainably with Earth's finite resources, and "we are also in a position to influence the outcome."

The authors conclude their book by observing that they have dedicated it to educating readers so they will know what they are talking about when they make choices related to science and technology in their lives. The examples of the preceding two paragraphs show that those who read this book carefully will indeed be better-informed citizens. As I read it, I felt that the authors were speaking directly to me, and I hope that other readers will feel the same way. This book also brought back many fond memories of my own introductory physics course and made me wish that I was still teaching an introductory college physics course—for, if I were, I would certainly want to use this book.

***Reviewer:***

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