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ACCURACY REPORT

Report on the book Physics, Principles with Applications by Douglas C. Giancolli (John Wiley & Sons, ISBN: 0-13-061143-3)

General comments:

This book is in its Fifth edition and, as one might expect, I found no egregious errors in the book. I found very few serious errors and only a few typographical errors. It should be pointed out that I was able to review only the sections on Mechanics, Thermodynamics, and (portions of) Electricity and Magnetism (E&M), that is roughly the first 600 pages, and Appendix A.

I found this book to be thorough and well written. Probably it was designed to be a one-year algebra-based college physics text. When used for a high school AP algebra-based physics class, it would be impossible to cover every chapter in a one-year course.

Therefore, the size of this book (and its weight) might be overwhelming to a high school student. It would be nice if such a book could be published in two volumes, the first comprising Mechanics, Thermodynamics and E&M for a high school physics class, and a second volume containing optics, and topics of modern physics: atomic nuclear, elementary particle physics and astronomy. The latter could be made into pamphlets for the teacher to hand out on subjects of their particular interest. This would reduce the weight of the book (it weighs 5+ lbs) and focus the topics for instruction to what will best prepare high school students for advancing into college physics or chemistry.

The mathematical review (Appendix A) is well written and very concise. If I were teaching physics I would go over this first to make sure the students were prepared for the mathematical rigor expected. Vectors can not be overemphasized. This concept is likely to be completely foreign to high school students and needs to be taught with rigor (maybe more than is used in this text) and constantly through the year in lectures, problem solving sessions and laboratories (where it is reinforced by experiments involving frictionless air tables or air tracks).

Serious Errors (note: in the formulas below a^2 = a*a):

The most serious error I found in the book occurred in Appendix A. It is in Example A-2 (p. 1040). The solution to the equation a^2b + c = 24 is stated to be sqrt ((24 - c)/b). The answers should be a = + sqrt ((24 - c)/b) or - sqrt ((24 - c)/b). That is there are two solutions for variable a to the equation proposed. This is actually well explained two pages later on page 1042, where the Quadratic formula is discussed (which of course has two solutions). *No change. Though the author understands the point regarding the mathematics, he is concerned about timing. The author believes, as a matter of pedagogy, that it is better not to tell the students everything in the first example. This is a review of elementary algebra for students who may have forgotten it. As the reviewer notes, this point is effectively made* In fact the statement at the bottom of that page: “In physics problems, it sometimes happens that only one of the solutions corresponds to a real-life situation; in this case, the other is discarded.” This is a very important point and should be placed in the main text. *Agreed that this point should appear in the main text. It is discussed in Examples 2-13 and 2-15 on pp. 36, 37.*

One place this could be emphasized is in Example 2-7 (p. 30). When inverting the equation x = 1/2 a t^2, to give t^2 = 2 x /a. The solutions to the new equation are + sqrt((2 x)/a)) and - sqrt ((2 x)/a)), but only the positive solution is physically meaningful. Another place in the text where two solutions can occur from a similar equation is on page 162. There the velocity is given as v1^2 = 2 KE/m. This has two solutions v1 = + sqrt(2 KE/m) and v1 = - sqrt(2 KE/m), but only the positive term has physical meaning. This error should be corrected in the book so that students will understand that while mathematically there are indeed two solutions, physically we find that only one can be correct. Instilling mathematical rigor at an early age cannot be overemphasized.
Author respectfully disagrees that these are errors. The author agrees with the reviewer's point regarding the mathematics, although he is concerned about diluting the points of

physics with too many details of math, especially this early in the book. The author strives not to overwhelm students.

The section on the Binomial Theorem is well done, but I did not see where in the text it was used.
Publisher thanks the reviewer for positive comments. Theorem is discussed in the footnote on page 798.
Logarithms are likewise well explained. The section on intensity of sound (Section 12-2) in particular is well done and is good for training the students in the use of logarithms.
No change. Publisher thanks the reviewer for positive comments.

As a musician, I found Chapter 12 on Sound particularly well done and thorough. This is an area of physics that students, given their general interest in music, should find very interesting. The special topic of ultrasound and medical imaging is also a good, practical application of sound waves. This Chapter (12) demonstrates the strengths of the book, providing good real-world examples of physics in action. A high school teacher will have a wealth of material to draw on for classroom and laboratory instruction. *No change. Publisher thanks the reviewer for positive comments.*

Another serious error has to do with the first introduction of vector quantities. The author refrains from using vector concepts until Chapter 3, Kinematics in Two Dimensions, but vectors are important for one-dimensional motion too, for example predicting the path of a ball tossed in the air. Vectors should be discussed before introduction of material on displacement, velocity and acceleration. Then discussion of these topics can assume a "vector" framework from the start. This leads to less confusion for the students. For example, it would be better to introduce vector notation prior to one-dimensional kinematics (pp. 20 - 28). Teachers can do so by using material from Sections 3-2 on addition and subtraction of vectors simultaneous with one-dimensional kinematics.
No change. The author respectfully disagrees that this is an error. As a matter of pedagogical preference, the author believes that pacing of content for students, especially at the beginning of the course, is vitally important. Author has determined that if vectors are taught out of context, they have to be re-taught later.

In Examples 2-11 and 2-12 (p. 34), the author says "Assume y is positive downward". Then in Example 2-13 (p. 35), y is chosen to be positive upward. In Examples 3-3 (p. 61) and 3-4 (p. 62), and from thence on as far as I can tell, the author takes the y direction to be positive upward, so that gravity acts in the NEGATIVE y direction. Of course one can take y as positive downward, but I think this may confuse the high school student. I would suggest that it would be better to do Examples 2-11 and 2-12 in Chapter 2 using proper vector notation and assuming that the "y" direction is positive upward, such that gravity acts in the NEGATIVE "y" direction. *No change. The author respectfully disagrees that this is an error. The author purposefully makes the point that there is a choice to be made when solving such problems. Students learn that they must choose their framework and that the answer doesn't depend on assumptions. Otherwise, students tend to think this is a law or rule. Students must learn what is a choice or assumption and what is not.*

Suggestions for clarity:

The concept of a "system", a collection of objects that interact with each other, is defined on page 183 (Chapter 7). But this might have been better placed prior to discussing "net forces" on an object" page 79 (Chapter 4). This is a small point, but might improve the students understanding of the classical laws of motion.
No change. The author and publisher thank the reviewer for this suggestion.

The author notes in the preface that the section on angular momentum was "simplified a bit, especially vector aspects." This results in an important concept of physics, the "right hand rule", being placed in a special section (Section 8-9, p. 230) marked with an "*". Teachers who use this book should not skip this section, as the vector notation for angular momentum is an important concept. The "right hand rule" is again used on page 591 to get the direction of current from the direction of the magnetic field. The use of the "right hand rule" is so basic to E&M that it should be introduced earlier (as in Section 8-9) so the students can get some familiarity with it.
No change. The author has taken this approach because of his great sensitivity to the pacing of new information to the students. The right hand rule is marked optional in Section 8-9 to let teachers and students know that it is not a crucial topic at this point. The rule is covered again in a "non-optional" section in Chapter 20.

The Section on elasticity (Section 9-6) is excellent, and again very thorough, with good practical examples of tension in piano wires, compression in supporting columns in buildings, and design of arches and domes. I found this Section very well done and quite interesting. *No change. Publisher thanks the reviewer for the positive comments.*

The concepts associated with Simple Harmonic Motion (SHM), which are discussed in Chapter 11 (Vibrations and Waves), should come before the potential energy of a spring (Section 6-4, p. 156). Also, the definition of Hooke's Law, defining the restoring force for a displacement of the spring, comes later in Section 9-6. A separate Chapter on "Vibrations" or "Oscillations" could combine the potential energy of a spring (pp. 156-157, with definition of Hooke's Law (p. 253), and the first part of Chapter 11 (Sections 11-1 through 11-7). Barring a reworking of the book, teachers should just be aware of this when presenting the subject of SHM. *No change. The author and publisher thank the reviewer for these suggestions.*

Another section of repeated material occurs in Chapter 12 (bottom of p. 357) in discussing harmonics and overtones. This is a repeat of the material in Chapter 11 (top of p. 336). The footnote on page 357 is in fact in the text on page 336. So reference could be made on page 357 to what was said on page 336.
In addition to the footnote, the paragraph on p. 357 does reference Section 11-12.

Section 13-1 makes more sense if placed between Sections 13-10 and 13-11, that is prior to "Kinetic Theory and the Molecular Interpretation of Temperature. As an alternative, Section 13-1 could be used as a lead into the discussion of Temperature, by creating a connection between them at the end of Section 13-1.
13-1 is a good introduction that, among other things, introduced "atoms." Even if not used much until Section 13-10, it allows reference to atoms before 13-10.

Serious Confusion:

Two sections led to serious confusion. The first was this statement in Chapter 11 (p. 328). The text states: "But in a fluid, only longitudinal waves can propagate, because any transverse motion would experience no restoring force since a fluid can flow. This fact was used by geophysicists to infer that the Earth's OUTER CORE is molten: longitudinal waves are detected diametrically across the Earth, but not transverse waves." My first response was that I knew that the INNER CORE was molten. There is a fluid outer core (see: http://www.ucsc.edu/currents/01-02/12-03/earth.html) as well as a fluid inner core. Perhaps this comment in the text needs to eliminate any confusion.
Thank you. The author is reviewing the references provided and will make any necessary corrections to facts.

The second confusing statement is also in Chapter 11 (p. 339): "As a rule of thumb, only if the wavelength is smaller than the size of the object will there be a significant shadow region. It is worth noting that this rule applies to reflection from an obstacle as well. Very little of a wave is reflected unless the wavelength is smaller than the size of the obstacle."

This seems in contradiction to the text in the Figure 11-44: "Water waves passing objects of various sizes. Note that the larger the wavelength compared to the size of the object, the more diffraction there is into the 'shadow region'." The caption is supported by the formula in the text (p. 339), theta = lambda/L, i.e. the diffraction is greater if the wavelength (lambda) is LARGER than the size of the obstacle or slit (L).

Note that in Resnick and Halliday's Physics (John Wiley & Sons, 1966), this concept is expressed as follows (p. 1037) where I have replaced the slit width a by the symbol L for purposes of comparison: "Diffraction can be ignored if the ratio L/lambda is large enough, L being a measure of the smallest sideways dimension of the slit or obstacle. If L >> lambda, light appears to travel in straight lines which can be represented by rays that obey the laws of reflection and refraction."

So I think that the text on p 339 of Giancoli should read:

"As a rule of thumb, only if the wavelength is LARGER than the size of the object will there be a significant shadow region. It is worth noting that this rule applies to reflection from an obstacle as well. Very little of a wave is reflected unless the wavelength is LARGER than the size of the obstacle."

No change. The author maintains that there is no contradiction here. The statement cited from Halliday and Resnick is consistent with the Giancoli text.

Typographical Errors:

I found very few typos in the text that I was able to read carefully.

In the preface on page xv, there is an "of" that needs to be removed in the first sentence of the 3rd paragraph under "General Approach". "As mentioned above, this book includes of a wide range of examples…" needs to read: "As mentioned above, this book includes a wide range of examples…"
This has been corrected in the most recent printings of the book.

-- On page 349 (Example 12-2), the answer would round to f = 5.8 ms, rather than 5.9 ms
Publisher agrees to correct this in the next printing.

The statement on page 381 that
"Today the atomic theory is GENERALLY accepted by scientists." should read:
"While at one time the atomic theory was very controversial, today the atomic theory is accepted by scientists." as the text goes on to support this.
No Change. We feel that this is a matter of taste, not a typographical error.

Figure 11-37 (c) seems to be in error. The bottom curve does not look to be the sum of the top two curves!
We have recently redone figure 11-37 (c). It will appear in the next printing.

A small quibble in Appendix A, Section A-1 is that "ancients" had arrived at a value of pi = 3. Ptolemy (a Greek) arrived (in 150AD) at a value of 3.14166 (http://www.cecm.sfu.ca/projects/ISC/Pihistory.html).
No change. The author states that the ancients arrived at a value of 3.1416, and specifically points out that he is rounding.

Final Comments:

On the whole I found this book to be free of any egregious errors and to have very few serious or typographical errors. Its strength is that it has a multitude of practical applications of physics and these Sections (and the entire text) are well written. So the student gets some very practical understanding of how physics applies in real life. This is important for the high school student.

I found this book to be well written and free of any substantial error. I would recommend it as a text for high school AP algebra-based physics.

This report was edited to assure focus on the established purpose of identifying errors of fact.