

## Merits of Advanced Placement Reexamined

**J**erry Gollub and Robin Spital's recommendations for improving the Advanced Placement physics program (PHYSICS TODAY, May 2002, page 48) are excellent, as far they go. But they omit the fact that AP physics makes sense only if it is preceded by a broad conceptual physics course. The College Board states that "the strongly recommended format for both [AP] Physics B and Physics C courses is a second-year course following the usual introductory physics course" that "better prepares [students] for more analytical approaches taken in AP courses."<sup>1</sup> Unfortunately, most AP students have had no previous course that emphasizes concepts over calculations (see PHYSICS TODAY, October 1999, page 68).

For at least three reasons, a broad and conceptual first course is an essential prerequisite to any more technical course. First, as the College Board and lots of physics education research have shown, a grounding in the concepts of physics is an essential prerequisite to a meaningful math-based treatment.

Second, for many practical reasons, math-based high-school courses must concentrate on Newtonian mechanics. So-called modern physics, our current view of the physical universe, is hardly mentioned. Many future biology, medicine, engineering, and other students, then, will never take a course that presents such central concepts as quantum uncertainty and the relativity of time.

And third, traditional math-based courses give no time to such societal topics as energy resources, global warming, pseudoscience, and scientific methodology. Yet it is fairly obvious that industrialized democracies cannot survive unless their citizens are literate in such topics. The

American Association for the Advancement of Science puts this fairly strongly: "Without a scientifically literate population, the outlook for a better world is not promising."<sup>2</sup>

Students who skip a broad conceptual course to enter AP physics are harmed more than helped; they would opt for the broader course were the AP choice not available. Although AP physics is better than no physics at all, a conceptual course plus AP is far better still.

### References

1. *Advanced Placement Program Course Description: Physics*, College Board, New York (May 2001).
2. F. J. Rutherford, A. Ahlgren, *Science for All Americans*, Oxford U. Press, New York (1990), p. vi.

**ART HOBSON**  
(ahobson@uark.edu)  
University of Arkansas  
Fayetteville

**I** applaud PHYSICS TODAY for featuring an article on advanced physics education in American high schools. Jerry Gollub and Robin Spital offer good suggestions for what high-school physics students need. I am greatly disappointed, though, that so much attention was given to the Advanced Placement program. I took AP courses in Latin, Spanish, Calculus BC, and Physics (mechanics only), and I believe the AP program is more of an obstacle than an aid to providing quality advanced education. Students use AP exams only to boost their resumés. And from the reaction of faculty, I concluded that AP scores did tremendous things for the reputations of high schools. So much for knowledge for knowledge's sake.

The article did not mention the economics of the AP program. Currently, the cost for taking the AP examinations is \$85 each. Why should a student or his or her parents have to pay such a hefty sum, especially when the high cost of college tuition is looming? How much of that fee goes toward paying graders of the exam and how much toward promoting the AP program and lobbying high-school administrators? Although students are informed of the many benefits of taking AP exams, very few are told that most universities and colleges offer place-

ment tests for free. The most disparaging effect of the high cost is on students with lower socioeconomic status. As the authors stated, those students "do not fare as well on the examinations (on average)," which makes the exam an even larger waste of their money.

The loss to the student is not only monetary. This year, the AP examinations were administered during the first week in May, which gave AP students limited time to learn advanced, complex topics. Given the limited time and a very structured syllabus, laboratory experience falls by the wayside. The statistics I would like to see are the numbers of AP teachers who offer experimental work to their students. I would expect very few, because the pressure is mounting to achieve high test scores. The irony is that, as scientists and teachers of science, we preach to students that theory and experiment work hand-in-hand to advance our understanding of the universe.

I am also disappointed in the authors' suggestion that "formal calculus should not be required." Without calculus, physics reduces to a set of equations that the authors do not want students to memorize. Students should be given the elegant mathematical tools to broaden their understanding of physics.

I suggest we abandon the AP program altogether. The University of Chicago does not accept AP scores, and that stance has not hurt its reputation. Let's break the constraints of the standardized system and allow schools to develop their own advanced curriculum. Of course, local curriculum development on an as-needed basis will require qualified, confident, and experienced physics teachers. College professors are expected to develop their own courses; why not high-school teachers?

**MICHAEL H. WOOD**  
(mikewood@jlab.org)  
Thomas Jefferson National  
Accelerator Facility  
Newport News, Virginia

**O**ne of Jerry Gollub and Robin Spital's principal recommendations for improvements to the Advanced Placement physics program is to develop a high-school physics

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