assure us that the process is correct; it says nothing about the physics that Galileo insisted his definition satisfy.

What can we do? Follow Galileo. Forget putting the definition in the textbooks. Have the students carry out experiments. Encourage them to investigate the phenomenon first before we throw definitions at them. They will learn that velocity is not always constant, that the problem is not trivial, and that they have a lot more to learn, perhaps in high school, maybe in college.

Reference

1. Galileo, *Dialogues Concerning Two New Sciences*, H. Crew and A. de Salvio, trans., Northwestern U. Press, Evanston, Ill., and McGraw-Hill, New York (1963), Third Day.

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A Reader Inquires: Origin of 'Critical Mass'

Essayist William Safire, in a recent magazine column,[1] attributed the coining of the term "critical mass" to British science historian Margaret Gowing in 1940. However, that seems unlikely: In 1940, Gowing was an undergraduate studying economic history at the London School of Economics.[2] The *Oxford English Dictionary* (2nd edition, Clarendon Press, 1989) gives several examples of the use of the term, the earliest tracing through Gowing to the famous Frisch–Peierls memorandum of March 1940.[3] Otto Frisch and Rudolf Peierls used the terms critical size, critical amount, and critical radius but not critical mass.

It may be impossible to determine the term's origin in the rush of events surrounding the discovery of fission. Determining when it first appeared in the scientific literature would be an easier task. Three papers from May and June of 1939 explored the conditions necessary to sustain a chain reaction.[4] The first, by Francis Perrin, was published in the 1 May edition of *Comptes Rendus B*. Near the bottom of the second page of that paper, in the context of achieving a moderated-neutron chain reaction in U_3O_8, he wrote, "d'ou une mass critique M_C de 40 tonnes." The only slightly later papers by Siegfried Flügge and Peierls did not mention critical mass, but Peierls did use the term critical thickness.

Do any readers know of a precedent for "critical mass" earlier than Perrin's paper?

References

1. W. Safire, *New York Times Magazine*, 27 July 2003, p. 15.
2. For a brief biography of Gowing, see http://www.keele.ac.uk/depts/ir/gowing/career.htm.
3. R. Serber, *The Los Alamos Primer: The First Lectures on How to Build an Atomic Bomb*, U. of California Press, Berkeley (1992).
4. F. Perrin, *Comptes Rendus B* **208**, 1394 (1939); S. Flügge, *Naturwissenschaften* **27**, 402 (1939); R. Peierls, *Proc. Cambridge Philos. Soc.* **35**, 610 (1939).

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Author, Reviewer Play Ball

It may not be good form for authors to respond to reviews of their books—but forbearance has its limits. In his review of my book *The Science of Soccer* (PHYSICS TODAY, June 2003, page 64), John D. McCullen says that I give an "extraordinary incorrect" account of the bounce of the ball. In fact, my description is perfectly good physics. In a nutshell, here it is.

One can simply say that, during the bounce, the force on the ball is the reaction force from the ground to the equal air-pressure force on the contact area. Alternatively, one can correctly say that the total force on the casing of the ball in contact with the ground is zero (it is not accelerating), and in this description the force on the casing is the unbalanced pressure force on that part of the upper surface opposite to the part of the casing in contact with the ground. In the book, I give both descriptions. Each has its merits and both, of course, give the same correct answer.

A full account of the dynamics is given in the book, the first chapter of which is devoted to the ball and the bounce.

John Wesson
Abingdon, England

McCullen replies: John Wesson's second version of the force analysis on the ball casing requires us to envision that the ball is pushed up by the internal pressure of the contained air on the upper part of the casing. But of course the total effect of that pressure on the whole casing is zero, as his analysis confirms. Splitting its effect into parts just confuses the issue—and therefore any statement about the cause of the bounce—for the reader.

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Next-Generation Discriminating Reader

This unposed, candid photograph shows our two-year-old grand-

ELAINE R. CERNY

daughter, Audra Cerny, reading a copy of PHYSICS TODAY. Note that other scientific publications were available on the step behind her, but they did not attract her attention.

We believe it's never too early to expose children to the good stuff. Perhaps we have another physicist in the family.

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Corrections

November 2003, page 13—Vit Klemes is no longer affiliated with the National Hydrology Research Institute, formerly in Saskatoon, Canada. He is retired and living in Victoria.

November 2003, page 76—The LTT-h low-temperature transformer does not come in four separate models; it incorporates four transformer modes in the one model. ■