should have been provided.

The author's professional background is in meteorology, and he has written *The Winds: The Origins and Behavior of Atmospheric Motion* (Momentum Book no. 19) and, with a coauthor, *The Dynamics of Aerocolloidal Systems.* From the text, there is no evidence of a personal acquaintance with the ocean. Hidy appears to have leaned heavily on his meteorological background and a rehash of material found in various oceanographic texts. He chooses to perform quite a few unnecessary manipulations of fluid-dynamical relationships, and he introduces geostrophic relations several times over in a fragmented way.

To be more specific, in outlining the trend to large research programs, the author mentions further meteorological programs such as GARP while omitting the oceanographically important IDOE (International Decade of Ocean Exploration). He dwells upon old instrumentation, such as Nansen bottles and Ekman current meters, while modern instrumentation, such as a salinity-temperature-depth profiling system, is omitted. There is nothing on the wide use of moored bouys with recording current meters and other sensors. On page 28 he mentions that no vertical velocity observations have been made, whereas published accounts of such observations have existed since 1968. On page 32, he infers that the subsurface, neutrally buoyant, Swallow floats are used with radio direction finding, whereas they are used with acoustic direction finding. He neglects to mention electromagnetic current sensors other than the GEK, giving the impression that electromagnetic techniques could only be used from ships. His definition of the density anomaly σ_t, on pages 38-39 is wrong. He defines it as $\sigma_t = (\rho_{S,T,P} - 1) \times 1000$ rather than $\sigma_t = (\rho_{S,T,0} - 1) \times 1000$. On pages 42-45 he discusses static stability without noting the need for an adiabatic term, especially in deep water. The author states on page 81 that "motion in inertial circles is rather rare in the oceans;" but such motions have been widely reported since lengthy time series of currents have been observed in the 1960's. On page 90, he uses the term "undercurrents" when he appears to mean "countercurrents," and vice versa. Nothing is mentioned of oceanic microstructure in chapter 8, "The Fine Structure of Ocean Currents."

There are many other examples of inaccurate or careless statements. Nonetheless the casual reader will probably not be seriously misled. It is regrettable that this book could not have been more accurate and contemporary. If the style and content had been more exciting, the book could have more effectively served to attract physicists and engineers to the rapidly advancing field of physical oceanography.

Christopher N. K. Mooers
Rosenstiel School of Marine and Atmospheric Science

Flames: Their Structure, Radiation and Temperature

By A. G. Gaydon, H. G. Wolfhard
401 pp. Barnes and Noble (Chapman and Hall), New York, 1970. $19.00

Flames and flame phenomena constitute a major branch of combustion. The field is of practical interest, since combustion processes provide the major source of energy for industry, transportation and most other needs of society, while on the other hand unwanted fires present a major social problem. Flames are studied principally in the gas phase, but they are also important to solid-phase combustion, since the major exothermic stages in the burning of liquids and solids normally occur in gas-phase flames. Under the stimulus of interest in jet and rocket propulsion, studies in this area increased sharply in the years following World War II. As a result of world-wide scientific effort, there has been a revolution in the understanding of this phenomena. These efforts reached a peak in the 1960's, and the past few years have been a period of consolidation. Therefore, this is a desirable period for the production of a general text.

The authors, Alfred G. Gaydon and Hans G. Wolfhard, were pioneers and have remained contributors in the field of combustion during the past two decades in which combustion understanding has come to maturity.

The approach of the authors has been academic rather than practical. Therefore, areas of industrial interest, such as engine problems, industrial furnaces and burners, and pollution combustion receive little coverage. Related areas, such as flame stabilization, ignition, fire suppression and detonations also have received minimal coverage.

The book provides a well written introduction to the study of flames. The coverage is not perfectly balanced. It is weak in recent information in the areas of flame structure and flame theory. By contrast, several specialized areas, such as acoustic interactions with flames, the formation of carbon temperature measurement and calculation and ionization receive quite detailed treatment.

The book is relatively free of errors, both typographical and technical, as befits a third edition. The only major criticism I would make it that the authors have not made as much use of the opportunity to bring the book up to date as would be desirable. This is particularly serious in the case of the chapter on flame temperature calculations, where the impression is given that these calculations are commonly made by hand. No mention is made of recent compilations of thermodynamic information, such as the JANNAF (Joint Army-Navy-NASA-Air Force) Thermochemical Tables or the availability of standard programs for such calculations (such as "Kinetics and Thermodynamics in High Temperature Gases,"—NASA Document NASA SP-239). In these days when even students have access to powerful computers, the comparison between a hand calculation of many hours and a machine calculation costing only a dollar or two makes hand computations obsolete.

R. M. Fristrom
The John Hopkins University

Conceptual Physics: A New Introduction to Your Environment

By P. G. Hewitt
558 pp. Little, Brown, Boston, 1971. $9.95

My wife, who is a typical nonscientist, once took a summer course from a young astrophysicist. He told the class that it was not possible to learn any science without calculus, and that he personally could not remember when he did not know calculus. Many of my friends, although they have better memories, share his view that physics without calculus is not physics.

My own opinion is that it is possible to teach a great deal of good physics with very little mathematics. But what about physics with *no* mathematics? If you pick up Paul G. Hewitt's book, *Conceptual Physics,* and give it a cursory examination, you might conclude that he is trying to do exactly that. But this raises the question: What is mathematics? It is in fact more than algebraic equations and differentiation and