"Electrical Measurements"? In the same class are the chapters on "Electronic Circuits" and on "Vacuum Techniques" mentioned earlier, as well as those on "Photometry and Illumination," and on "Accelerators." Such subjects might be reserved for a future handbook of applied physics, in which they could receive more complete attention.

The opposite conclusion might be drawn in regard to the chapters on branches of mathematics, where in a handbook of physics, a strong emphasis on applied mathematics (as this term is used by mathematicians), rather than on pure mathematics, would appear to be desirable. To be sure, there are very good chapters on "Analysis" and on "Numerical Analysis," by John Todd, on "Tensor Calculus" by Cornelius Lanczos, and on "Probability Theory" by C. E. Eisenhart and M. Zelen, but not all of the remaining chapters on branches of mathematics appear to be of comparable relevance to a handbook of physics.

This edition of the handbook contains a very extensive and carefully prepared index, with far more entries than the first edition. The typography and illustrations are excellent. On the whole, the publication of this revised edition of a highly regarded and useful book should be welcomed by the physics community, as well as by scientists generally.

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Phase shifts

VARIABLE PHASE APPROACH TO POTENTIAL SCATTERING. By F. Calogero. 244 pp. Academic Press, New York, 1967. $11.50

by John L. Gammel

It is hardly necessary to review this delightful book in much detail. It can be read through very rapidly so that anyone interested in scattering theory will be able to judge its value to himself almost immediately.

The book starts with a derivation (from the Schrödinger equation) of a first-order differential equation for a quantity tan $\delta(r)$ (the tangent of the phase shift resulting from a potential truncated at r, or, what is the same thing, the contribution to tan δ resulting from that part of the potential lying between 0 and r), and similar equations for $\delta(r)$, or $S(r)$ [the S matrix exp $(2i\delta)$], or the scattering amplitude $A(r)$. The advantage of the method is that it deals directly with a quantity of physical interest; namely, the phase shift, or at any rate a simple function of the phase shift. The method can be described as an imbedding method since the phase shift for many potentials (obtained by many different truncations of a single potential) are calculated simultaneously.

Then special subjects are treated: bounds on the phase shift and its variation with energy, Born approximation and a scheme for improving it, variational principles, simultaneous maximum and minimum principles, singular potentials, scattering by Dirac particles, scattering by nonlocal and complex potentials, multichannel scattering, poles of the S matrix and Levinson's theorem.

The author states in the preface that ". . . this method of discussing scattering phase shifts should be introduced in all elementary quantum mechanics courses that include a treatment of scattering theory." This statement may be true; I recommend that all teachers of such courses look at the material and form their own judgements.

It is more difficult to estimate the value of the method in advanced research. My guess would be that as a practical computing device, the method has no advantage over more usual techniques; in fact, tan $\delta(r)$ is a spectacular function of r for some potentials and some energies as can be seen by inspecting the figures in the book. But this question is beside the point; the questions of principle that can be decided by the method are of more interest. Many interesting results on the poles of the S matrix and Levinson's theorem are obtained by elementary methods. I wondered if it might be possible to prove the convergence of the Padé approximants to the Born series for tan δ by this method. This possibility presents itself because the first-order differential equation derived for tan δ is a Ricatti equation. No doubt other applications will present themselves to other researchers.

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Toward a unified science of materials

STATISTICAL MECHANICS, THERMODYNAMICS AND KINETICS. By Oscar K. Rice. 586 pp. W. H. Freeman, San Francisco, 1967. $12.50

by Herman A. Liebhafsky

In the preface to his *Statistical Mechanics,* J. Willard Gibbs wrote: "Moreover, we avoid great difficulties when, giving up the attempt to frame hypotheses concerning the constitution of material bodies, we pursue statistical inquiries as a branch of rational mechanics . . . . Difficulties of this kind have deterred the author from attempting to explain the mysteries of nature." A successful fusion of statistical mechanics, thermodynamics, and kinetics—the consummation wished for above—would be a great step toward such an explanation, and it would be evidence that a single, unified materials science might someday exist. Fusion of the first two disciplines is well under way, but kinetics is certain to prove refractory because it deals with systems that usually change with time at rates that neither statistical mechanics nor thermodynamics can now reliably predict.

The author is Kenan Professor of Chemistry at the University of North Carolina. He has done distinguished work in each of the three disciplines in his book. Because of the difficulties associated with kinetics, it is fortunate that he has long been an authority in this field.

The book is intended primarily for chemists in their senior and graduate years. To an unusual and welcome degree, it bears the impress of its author. Again to an unusual and welcome degree, conclusions from statistical mechanics are compared with experimental results. Many searching questions and testing problems are included.

In most "statistical inquiries as a branch of rational mechanics," the approach to "rational thermodynamics"—another of Gibbs's phrases—is by way of Boltzmann's H theorem through the partition function and entropy to the Helmholtz free energy. The author, following the lead of W. F. Giauque, in a sense reverses this approach in chapters 2 and 3. He begins with the Gibbs free energy, which is simply related to the