It is not necessary to make 120 determinations in the calibration of the device or any orifice or capillary flowmeter. Since the pressure drop across the orifice is an exponential function of the air flow, a log-log plot will yield a straight line which simplifies the number of points necessary for accurate calibration. Theoretically two checked points (four determinations) at the upper and lower limits of the desired range will fix the calibration; however, it is customary to make a further check by checking a third point at an intermediate air flow.

The device is also limited in making accurate samples of air from flow in ducts or pipes, since its entrance is too short. For accurate duct or pipe sampling it is customary to traverse the cross-section of a duct since the air flowing at the walls of the duct is not moving at the same rate as portions near the centerline. It is also necessary in accurate duct sampling to have the inlet velocity to the sampling tube at the same air velocity as the sampled air stream. The authors do not mention the necessity for this and fail to provide a long enough inlet to the flowmeter for duct traversing.

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SCIENTIFIC BOOKS

THE CHEMICAL PROCESS

Chemical Process Principles. Part I: *Material and Energy Balances.* By O. A. HOUGEN and K. M. WATSON. 452 pages. New York: John Wiley and Sons. $4.50.

THE reviewer desires to present the reactions of a professor of physical chemistry to this volume, the first part of a text-book of chemical engineering which deals with the principles underlying chemical processes as carried out in industry. Oftentimes our chemical engineering colleagues complain about the matter which the physical chemists present to students in the physical chemistry courses basic to chemical engineering curricula. A perusal of the present volume has provided one teacher of physical chemistry with an understanding of the factors underlying such complaints.

The volume presents, in some 450 pages and ten chapters, approximately ten topics including stoichiometry, ideal gases, vapor pressures, partial and complete saturation, solubility, distribution, sorption, thermophysics, thermochemistry, fuels and combustion and material and energy balances in important industrial processes. The physicochemical principles corresponding to these topics normally occupy approximately one fifth of a full-year course in physical chemistry. The authors of this text state, however, that the material of this first part of their planned complete text "is suitable for second- and third-year undergraduate work." A portion of the as yet unpublished second part "is suitable for third- and fourth-year undergraduate work; the remainder is of graduate level." Here then is the secret of the dissatisfaction sometimes expressed concerning fundamental courses in physical chemistry; the time available to the professor of physical chemistry is much too small to secure the desired result in the training of chemical engineers.

This present text indicates excellently the reasons why the standard physical chemistry course is inadequate for chemical engineering curricula. It shows that courses in chemical process principles resolve themselves into term or year courses in the solution of problems based upon the fundamental principles which the physical chemist can do little more than outline, can, at best, employ one hour per week in the discussion of such applications. It is a text, however, which every professor of physical chemistry would do well to have close at hand. It will help him to emphasize the topics which many of his students will later have to master in the thoroughgoing fashion that this book requires of its readers. It will be a source book for better problem work than the physical chemist normally requires of his students. It will give him a more sympathetic understanding of the labors of his chemical engineering colleagues that go into the development of the chemical engineering fraternity now so largely responsible for the high technical level of American chemical industry. The students who master this text are assured of an excellent introduction to the process problems of chemical engineering. They will go forward with a thorough preliminary training to the more difficult thermodynamic and kinetic phenomena that are promised in Part 2 of this text. In spite of war conservation regulations, the format of the book is pleasing. The right half of equation 2, page 60, is initially confusing. Some of the thermochemical data on pages 262 and 263 and in the following pages convey an idea of greater accuracy than is probably warranted by the data themselves. Perhaps kcal. should be used in several places instead of cal., for example, on page 273 but not as on page 310. The illustrations are excellently legible and illustrative. The problem illustrations are well presented and the problems to be solved abundant and well chosen.

HUGH S. TAYLOR