cover vegetation-types in higher latitudes or in very arid country should not be followed.

Another commonly misused word is *scrub*. Some have considered that a vegetation of shrubs is a scrub. This is true only if the shrubs are scrubby (in the usual connotation of sparse, dwarfed or malformed). Scrubby trees and scrubby bushes likewise are prevalent in certain areas. *Shrub,* as long advocated by Dr. H. L. Shantz, is a valid designation for cover made up of shrubs of normal stature and form. Scrub forest is composed of reduced and perhaps gnarled trees. Scrub woodland is an open cover of such trees.

Though a significant distinction between shrub and bush is not usually emphasized, it is frequently implied, and can be usefully employed, for vegetation as well as for growth-form of particular plant species. Most shrubs are larger than bushes, with relatively few, sizable, hard-wooded, long-lived stems. Bushes average smaller, with many stems which are slender. In many bushes the stems have large pith, little wood and are individually short-lived. Most Mediterranean maqui is evergreen shrub (with or without tree components in addition), whereas garrigue cover-types are chiefly bush (in the sense of bush vegetation). The corresponding American vegetation, sometimes called coastal sagebrush, might better be known as California bush, since it is far more extensive than the Artemisia species after which it was named and comprises over a hundred bush species.

There is considerable disagreement as to application of "chaparral." It has been used for a mixed shrub at the east front of the Rocky Mountains, for shrub of Nebraska sand hills, and for shrub mixtures in the eastern states. Texas botanists may rightly claim that mesquite shrub of the southwestern states has been called chaparral for nearly a century. (Chaparral of Texas is so defined in J. R. Bartlett's "Dictionary of Americanisms" in 1850.). But if so widely used, chaparral becomes merely a synonym of shrub vegetation. Several botanists have suggested that clarity will result if students of vegetation can agree to restrict the term to evergreen shrub. Most variants of this evergreen shrub are xerophytic rather than of types usually associated with forest. Chaparral is not limited to California nor to climates with rainfall only in winter; it occurs in its usual appearance but with fewer species, in mountains of Arizona, New Mexico and southwestern Colorado; and chaparral types with species of the usual genera occur in several parts of Mexico. If describers of deciduous shrub will refrain from calling it chaparral, the latter word can be usefully preserved. Mesquital or simply mesquite should be distinctive for Texas vegetation dominated by this one plant.

Attempts to visualize just what may be meant by "jungle" in accounts by various authors, usually result in confusion. To some minds jungle is synonymous with tropical rain-forest of Asia and the East Indies or with any tropical forest. From its first meaning as "waste or uncultivated ground (='forest' in the original sense)" (Oxford Dictionary) it has come to be applied to a wide variety of vegetation-types: brushwood, long grass, any tangled vegetation, "low or thin forest" (J. C. Willis), primeval forest, secondary forest. Many foresters and botanists working in India use the term rarely or not at all. The clearest statement found is by T. W. Webber:[1] "Dr. Johnson defines a forest as a 'wild uncultivated tract of ground interspersed with trees.' . . . In India the term 'jungle' has a similarly wide and uncertain meaning, not necessarily implying trees any more than the Scotch 'deer forest,' but signifying a region where savage animals dwell, and where wild men exist." Current wide use of the phrase "jungle warfare" should not lead followers of the news into picturing any one type of vegetational setting for the fighting in Burma or New Guinea or islands of the western Pacific. When a particular kind of vegetation is to be described, the word "jungle" is of no value. Use of this term for regions other than Indomalaya should be avoided in writings on science.

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NOTES ON "A FLOWMETER FOR USE IN AIR SAMPLING PROCEDURES"

I HAVE read the article "A Flowmeter for Use in Air Sampling Procedures," by H. M. Lemon and H. Wise, in the issue of SCIENCE for January 14. Industrial hygienists have used similar flowmeters for several years, and in this laboratory we consider this type of device as very commonplace. In our classes in industrial air analysis we emphasize the importance of calibrating the flowmeter with the sampling device when the flowmeter is placed downstream. The use of the flowmeter downstream of the air sampler has decided advantages in fume and gas sampling where the resistance of the sampler remains constant, as it eliminates apparatus to be cleaned and a source of error. It is difficult to clean certain metal fumes from the flowmeter placed upstream even with highly corrosive acids because of the adhesiveness of the fume particles.

A commercial air-sampling instrument for carbon monoxide (M.S.A. CO. Indicator, manufactured by Mine Safety Appliances Company), which has been marketed for over fifteen years, has a simple flowmeter of this type preceding the dehydrating canister and absorption chambers. The change in resistance of the dehydrating canister with absorption of moisture therefore does not affect the calibration.

[1] "The Forests of Upper India," p. ix. London, 1902.

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.

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