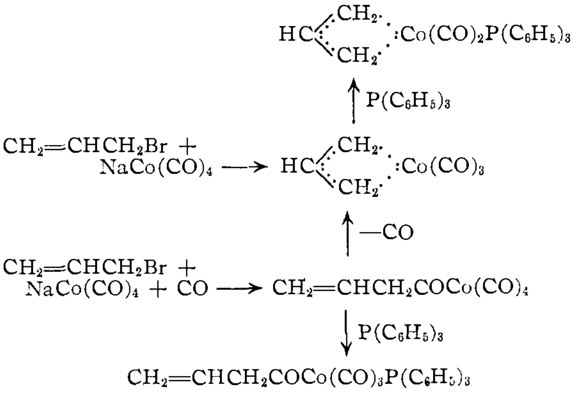
$RCo(CO)_4 \rightleftarrows RCOCo(CO)_3$ and $RCOCo(CO)_3 + P(C_6H_5)_3 \rightarrow RCOCo(CO)_3P(C_6H_5)_3$. This latter reaction constitutes a very convenient preparation of these complexes, an 86% yield of acetylcobalt tricarbonyl triphenylphosphine being obtained by treating excess methyl iodide with $NaCo(CO)_4$ at 0° in the presence of excess triphenylphosphine. $RCo(CO)_4$ should be formed as the primary product of the addition of $HCo(CO)_4$ to olefins; this reaction cannot be carried out in the presence of triphenylphosphine, because triphenylphosphine reacts with $HCo(CO)_4$ to give apparently $HCo(CO)_3P(C_6H_5)_3$, which is unreactive at 0°. The reaction of $HCo(CO)_4$ with a large excess of 1-pentene, followed by the addition of triphenylphosphine, has led to the isolation of a hexanoylcobalt tricarbonyl triphenylphosphine, m.p. 82–86° (dec.). *Anal.* Calcd.: C, 64.3; H, 5.20. Found: C, 64.5; H, 5.30. $HCo(CO)_4 + C_5H_{10} \rightarrow C_5H_{11}Co(CO)_4 \xrightarrow{P(C_6H_5)_3} C_5H_{11}COCo(CO)_3P(C_6H_5)_3$.

Allylcobalt tricarbonyl[2] reacts quite differently from simple alkylcobalt compounds. Treatment of it with triphenylphosphine liberates one mole of CO and yields allylcobalt dicarbonyl triphenylphosphine, m.p. 132° (dec.). *Anal.* Calcd.: C, 66.3; H, 4.85. Found: C, 66.3; H, 5.29. On the other hand, reaction of allyl bromide with $NaCo(CO)_4$ and CO in the presence of triphenylphosphine gives 3-butenoylcobalt tricarbonyl triphenylphosphine, identical with the product obtained from 3-butenoyl chloride, in spite of the fact that it has been shown[2] that 3-butenoylcobalt tetracarbonyl is converted on standing into allylcobalt tricarbonyl.



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BOOK REVIEWS

Progress in Inorganic Chemistry. Volume Edited by F. ALBERT COTTON, Department of Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1959. ix + 566 pp. 16 × 23 5 cm. Price, $14.50.

This is the first in an annual series of volumes devoted to "...maintaining effective, fruitful communication among the different branches of inorganic chemistry...". If the high standards generally typical of the contributions to this first volume are maintained, this series may well prove to be almost equally of interest and value to workers in the other fields of chemistry as well.

The seven largely unrelated topics reviewed in this volume are: Cyclopentadienyl and Arene Metal Compounds (G. Wilkinson and F. A. Cotton), Interstitial Compounds of Graphite (G. R. Henning), Uber Schwefel-Stickstoff-Verbindungen (M. Becke-Goehring), Metal-Ammonia Solutions (W. L. Jolly), Isocyanide Complexes of Metals (L. Malatesta), The Effect of Inner Orbital Splitting on the Thermodynamic Properties of Transition Metal Compounds and Coördination Complexes (P. George and D. S. McClure), and The Structure and Properties of Mixed Metal Oxides (R. Ward). It is an unfortunate but unavoidable fact that, owing to publication schedules, such discussions must always be incomplete relative to the current literature. For example, it is regrettable that the discussion of the structure of ferrocene and related species could not include more recent considerations of ionic models.

It is refreshing to find that, in accordance with stated editorial policy, these discussions reflect no efforts at oversimplification designed to appeal to a particular reader audience. At the same time, these discussions reveal only limited evidence of consciousness of a need to conform to the "sophisticated" approach.

The significance of this series to the literature of inorganic chemistry is best seen in context with the closely related series entitled "Advances in Inorganic Chemistry and Radiochemistry," Vol. 1 (Academic Press Inc., 1959) edited by Emelèus and Sharpe. Together these two new series provide ample evidence of the rapid postwar expansion and growth of the field of inorganic chemistry. It is to be hoped that editorial coöperation will minimize duplication of topics in succeeding volumes.

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Glutathione. Biochemical Society Symposium No. 17 held at Senate House, University of London on 15 February, 1958. Organized and Edited by E. M. CROOK, New York: Cambridge University Press, 32 East 57th Street, New York 22, N. Y. 1959. 115 pp. 16 × 25 cm. Price, $4.50.

"Glutathione," the subject of the Biochemical Society's 17th symposium, brings to the interested reader in condensed form both background and recent work on this ubiquitous substance. and supplements well the more comprehensive earlier American summary, "Glutathione: A Symposium," published in 1954. Different authors cover different facets of the subject.

Of special interest in the first chapter, "Chemistry and Biochemistry of Glutathione," by F. A. Isherwood, are considerations of the *pK* values of the different titratable groups in glutathione and speculations as to possible ring structures of the molecule which could explain certain of its properties. Pointed objections are made, however, by a discussant, N. W. Pirie. In the second chapter, "Techniques for Determining Glutathione," Christine G. Thomson and Heather Martin compare three selected methods and provide data to show their specificity, reliability and degree of concordance when applied to different test materials. Pirie makes the suggestion here that the method of deproteinizing used in analyses on tissue extracts may affect the values obtained for the proportions of the reduced and oxidized forms of glutathione. In the third chapter, "Enzyme Systems Associated with the Oxidation and Reduction of Glutathione in Plant Tissues," L. W. Mapson describes glutathione reductase, an enzyme which reduces oxidized glutathione to reduced glutathione by coupling reactions involving triphosphopyridine nucleotide dehydrogenases; dehydroascorbic acid reductase, which catalyzes the oxidation of glutathione by dehydroascorbic acid; and other enzyme systems in which oxidation ot glutathione can occur. Mapson also considers the not too convincing evidence that the glutathione–ascorbic acid system may function in an *in vivo* respiratory pathway; he states less equivocally, however, the probable greater physiological importance of glutathione in activation of sulfhydryl dependent enzymes. In "Glutathione Metabolism in Animals," P. C. Jocelyn describes first the different enzymes capable of synthesizing or breaking down glutathione; then the functions of glutathione as a cofactor for different enzymes, as a carrier of acyl groups, and as a protective agent. Jocelyn also discusses the apparent influence of thyroxine, vitamin B_{12}, growth hormone and adrenal hormones in gearing the glutathione level to body requirements. In "Glutathione and Neural Tissues," H. McIlwain brings out the facts that the total glutathione concentration in the brain is 10 times that in the plasma, that up to one-third of the reduced form is rapidly converted non-enzymically to oxidized form *post mortem*, and that cerebral tissue contains potent quantities of glutathione reductase, glyoxalase, and different enzymes which catalyze the formation and hydrolysis of S-acetyglutathione. Finally, McIlwain considers evidence for connection between mental phenomena and blood glutathione and implies that it is inconclusive. S. G. Waley, in "Glutathione and its Analogues in the Lens," describes the natural occurrence in the lens of γ-glutamyl-α-amino-*n*-butyrylglycine. called ophthalmic acid, and other analogs and derivatives. He also discusses the findings that glutathione in the lens appears to be bound to protein, and that lens glutathione decreases with experimental cataract. In the seventh and last chapter of the book, "Thiols and Radiation Damage," D. B. Hope discusses the *in vivo* protective effects of thiols and other compounds and the various mechanisms which have been postulated to explain the protection. In addition, Hope describes some of his own studies, using X-rays on mice, which showed correlation between radio-protection and hypothermia.

Each chapter is highly informative. Some are more readily absorbed, however, than others. Isherwood's is a model of clear, succinct presentation. Waley and Hope each accommodate the reader by following their statements of findings with statements of interpretations, a practice not always followed by some of the other authors. McIlwain's style is somewhat ponderous.

In spite of the numerous findings which have accumulated concerning glutathione, the existence of unresolved problems is quite apparent. For example, there are uncertainties regarding the involvement of the glutathione-ascorbic acid system in respiration, the *raison d'etre* of glyoxalase, the effects of glutathione on protein thiol groups *in vivo*, and the mechanisms of radio-protection by thiols and non-thiol compounds. The book should be informative for the non-specialist in glutathione research, stimulating for the specialist.

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Structure and Properties of Thin Films. Proceedings of an International Conference held at Bolton Landing, New York, on September 9–11, 1959. Edited by C. A. NEUGEBERGER, J. B. NEWKIRK and D. A. VERMILYEA. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1959. xiv + 561 pp. 22 × 28.5 cm. Price, $15.00.

This book consists of the papers and discussions presented at an International Conference sponsored jointly by the U. S. Air Force Office of Scientific Research, Air Research and Development Command, and the Research Laboratory of the General Electric Company. For workers interested in thin films or the bulk properties of matter which may be investigated more conveniently with thin films, the book will be of inestimable value. There are forty-two papers with the subsequent discussions plus a panel discussion on the theory of surfaces.

Papers with emphasis on studies of thin film properties to reveal information on bulk properties include research on phase transformations, chemical reactivity, superconductivity, electrical resistance, Hall effect, magnetic properties and magneto resistance. Some papers deal with special properties such as chemical, mechanical, electrical and magnetic behavior not associated with the bulk form; the nature of the responsible states come under considerable discussion.

Another group of papers are concerned primarily with surface chemistry. These shed light on interactions at surfaces, and are important also to understanding the growth properties of thin films. Often good reproductions of electron photomicrographs illuminate the discussion. A final group of papers take up the theoretical aspects of electronic structure, of epitaxial relationships and of the interactions of atoms with thin films.

If the student or researcher wishes to explore the growing interplay of experimental approaches and concepts of the physicist and chemist, he can scarcely find a better book in which to delve. It makes a valuable contribution as well to basic research and, ultimately to development, in the quite divergent fields of devices and coatings.

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Tables pour le Calcul Direct des Constantes D'équilibre des Systèmes Chimiques aux Hautes Températures. Graphiques de Conversion en Composition a L'équilibre. Exemples de Calculs. By HENRI MAURAS, Ingénieur-Docteur, Chef de Travaux à la Faculté des Sciences de Toulouse. Masson et Cie, 120, Boulevard Saint-Germain, Paris-6, France. 1959. vi + 149 pp. 17 × 25.5 cm. Price, Broché, 1.650 fr.; Cartonné toile, 2.450 fr.

This book is an effort, directed primarily toward chemical and metallurgical engineers, to provide free energy data in a form permitting rapid calculations for reactions.

There are two main parts. The first consists of tables, in which the data are given as "component factors of equilibrium." The "component factor" is defined by the author as

$$\mathfrak{F} = -\frac{\Delta H_{298}(\text{form.}) + \int_{298}^{T} C_{\text{p}}\text{d}T}{4.575T} + \frac{S_{298} + \int_{298}^{T} C_{\text{p}}\text{d}T}{4.575}$$

for an element or a compound; so that when "factors" for the reactants and products are combined, the result is the logarithm of the equilibrium constant of the reaction. "Factors" are given at 20-degree intervals from 400°K. to a limit of 240°K. (Also given are temperatures of phase changes.) There seems to be no particular advantage in representing the data in this chosen manner. The National Bureau of Standards accomplishes the same purpose by reporting $\log K = -\Delta F(\text{form.})/4.575T$.

About one-quarter of the tables are for organic compounds, principally hydrocarbons. For the most part the author uses other compilations as a source of data. The main criticism of the tables is that the author has not used up-to-date values. Two of his sources of compiled information have been superseded by later revisions. Also, omissions and the selection of outmoded values could have been remedied by a brief literature search. For example, at 1,000°K., the value selected for alumina is in error by more than 20 kcal., titanium dioxide by 8 kcal.

The second part gives information designed to permit rapid calculations of equilibrium gas compositions. The author considers eighteen different types of reactions. Equations, tables and charts, expressing the equilibrium constant as a combined function of the equilibrium composition and total pressure, are supplied. Examples to illustrate the use of the tables and charts are given.

This book cannot be recommended as a source of thermodynamic information for those wishing to make the most accurate calculations possible. However, it is a handy compilation for order-of-magnitude calculations, and it could be used satisfactory as a teaching medium.

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