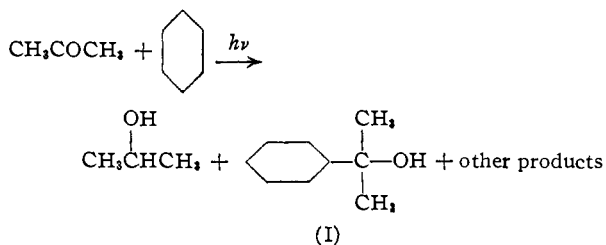


report our results on the light induced reactions of simple aliphatic ketones in saturated hydrocarbon solvents.<sup>7</sup> Ketones having no  $\gamma$ -hydrogen were found to give the corresponding alcohol and the addition product with the saturated hydrocarbon. Ketones with  $\gamma$ -hydrogens were found to give acetone, an olefin and a cyclobutanol derivative. These reactions demonstrate new types of photochemical reactions markedly different from those previously observed in gas phase. The formation of cyclobutanols indicates a simple, readily accessible synthetic route to a group of compounds otherwise difficult to prepare.

When a mixture of acetone and cyclohexane (1:8) was irradiated in a quartz immersion irradiator,<sup>8,9,10</sup> a small amount of methane and carbon monoxide was obtained. The products isolated by fractional distillation and gas chromatography were 2-propanol (53%), pinacol (15%), acetylacetone (8%), and cyclohexyldimethylcarbinol (I, 12%).<sup>11,12</sup> The recovered cyclohexane showed slight unsaturation. Cyclohexylcyclohexene and hydrocarbon polymers also were obtained.



Under similar condition, irradiation of 2-pentanone (IIa) in cyclohexane gave acetone, ethylene and 1-methylcyclobutanol (IIIa, 12%); phenylurethane of IIIa, m.p. 141° (Found: C, 70.14; H, 7.58; N, 6.84), identical with that of an authen-

(7) For a review on photochemical reactions, see C. R. Masson, V. Boekelheide and W. A. Noyes, Jr., "Technique of Organic Chemistry," Vol. II, Interscience Publishers, New York, N. Y., 1956, p. 257.

(8) M. S. Kharasch and H. N. Friedlander, *J. Org. Chem.*, **14**, 245 (1949).

(9) See ref. 7, p. 274.

(10) All reactions were carried out at 10–15° and the percentage conversions of the ketones ranged from 25 to 30%.

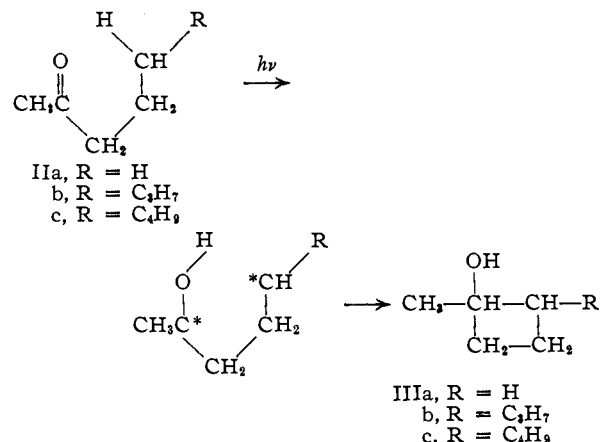
(11) P. Sabatier and A. Mailhe, *Ann. chim.*, [8] **10**, 539 (1907).

(12) E. J. Bowen and A. T. Horton, *J. Chem. Soc.*, 1685 (1936).

tic sample.<sup>13</sup> Compound (IIIa) and the authentic sample also exhibit identical infrared spectra and retention time in gas chromatography.

Irradiation of 2-octanone (IIb) in isoöctane gave, in addition to equimolar quantities of acetone and 1-pentene (67%), a saturated cyclic tertiary alcohol (IIIb, 17%) isomeric with 2-octanone, b.p. 67–68° (9 mm.),  $n_D^{20}$  1.4420 (Found: C, 75.00; H, 12.90); phenylurethane, m.p. 78° (Found: C, 72.75; H, 8.55; N, 5.72). The n.m.r. spectrum of IIIb indicates that it is 1-methyl-2-propylcyclobutanol.<sup>14</sup> Gas chromatography and infrared spectral analysis showed that the 1-pentene obtained was not contaminated by other isomers. Similarly, irradiation of 2-nonanone (IIc) in isoöctane yielded acetone (60%), 1-hexene (60%) and 1-methyl-2-butylcyclobutanol (IIIc, 10%), b.p. 49–50° (0.8 mm.),  $n_D^{20}$  1.4441 (Found: C, 76.21; H, 13.05); phenylurethane, m.p. 91° (Found: C, 73.42; H, 9.06; N, 5.73).

An intramolecular mechanism is formulated for the formation of cyclobutanols.



(13) Prepared from the reaction of cyclobutanone and methylmagnesium bromide.

(14) The authors wish to thank Dr. G. V. D. Tiers of Minnesota Mining and Manufacturing Company for the interpretation of the n.m.r. spectra.

INSTITUTE OF ORGANIC CHEMISTRY  
UNIVERSITY OF CHICAGO  
CHICAGO 37, ILLINOIS

N. C. YANG  
DING-DJUNG H. YANG

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## BOOK REVIEWS

**Experimental Crystal Physics.** By W. A. WOOSTER, Department of Mineralogy and Petrology, Cambridge. Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. 1957. viii + 115 pp. 14.5 × 22 cm. Price, \$2.90.

This book is based on a course in experimental crystal physics given at Cambridge. The topics covered are the optical, magnetic, thermal, plastic, piezoelectric, pyroelectric and elastic properties of crystals. The experiments described are "only those . . . which can be carried out in about two hours." For this reason the experiments are of necessity either qualitative or semiquantitative and deal only with the less complicated aspects of crystal physics. This is as it should be in a beginning course, although the

reviewer feels that a few four or six hour experiments should be (and probably are) thrown in among those described in the text. The course is excellent and should be emulated by all schools of crystallographers, crystal chemists and crystal physicists.

In reading the book, a certain amount of imagination is required in the reconstruction of the course. A piece of apparatus is described in terms of schematic diagrams which would be invaluable to the student faced with it in the laboratory but which would be of little help to one trying to build it. Circuit diagrams are also somewhat vague, giving resistances, capacitances and impedances, but often failing to mention voltages and occasionally giving nothing more than  $V_1$  or  $V_2$  to tell one what tubes should be included in a circuit.

The book will be useful to anyone teaching or wanting to teach a crystal physics course. It will be of little use to a research worker wanting to measure a particular physical property of a crystal in which he is interested. The need for a book which would present crystal physics in a form which would be useful to him is very great.

THE INSTITUTE FOR CANCER RESEARCH  
7701 BURHOLME AVENUE  
FOX CHASE  
PHILADELPHIA 11, PA.

A. L. PATTERSON

**Tables de Constantes et Données Numériques. Organisme Affilié de l'Union Internationale de Chimie Pure et Appliquée. No. 7. Constantes Sélectionnées. Diamagnétisme et Paramagnétisme.** By G. FOËX, Professeur à l'Université de Strasbourg, Correspondant de l'Institut. **Relaxation Paramagnétique.** By C.-J. GORTER, Professeur à l'Université de Leyde, and L.-J. SMITS, Masson et Cie., 120, boulevard Saint-Germain, Paris 6<sup>e</sup>, France. 1957. 317 pp. 21.5 × 27.5 cm. Price, broché, 8,800 fr.; cartonné toile, 9,700 fr.

This volume extends the prime service underwritten by la Commission Internationale des Tables de Constantes, by UNESCO, and by le Centre National de la Recherche Scientifique. The larger part of the present volume is due to the exquisitely painstaking efforts of Professor Foëx. The tables include appropriate introductory matter; magnetic susceptibility data for a host of elements, compounds, minerals and mixtures; and various substances under a wealth of different conditions. Principal susceptibilities are also given for many crystalline solids. The section on paramagnetic resonance is brief and, as expected, authoritative. Ferromagnetism is not included in this volume.

Here and there a doubt may be raised as to why one author's work was preferred to another's; as to the significance of susceptibility data on many minerals; as to the very one-sided view presented concerning transition group oxides and supported oxides and metals; and as to the lack of warning concerning the ubiquitous effects of hydrolysis in aqueous solutions. The truth of the matter is, of course, that in any such tables of experimental data the figures presented should be considered the beginning rather than the end of a search. Professor Foëx knows this and in most, if not all, cases references are included to alternate or more extensive treatises. The publishers rather apologetically admit that for typographical reasons the number of references after each datum is limited to five. A valuable feature is the author index containing about 1400 names. Any worker in the field of magnetic susceptibilities may at once determine whether justice has been done his own publications.

The work is indispensable for anyone interested in the application of magnetic susceptibilities to chemical problems. Authors, publishers, and underwriting organizations are all to be congratulated.

DEPARTMENT OF CHEMISTRY  
NORTHWESTERN UNIVERSITY  
EVANSTON, ILLINOIS

P. W. SELWOOD

**The Chemical Dynamics of Bone Mineral.** By WILLIAM F. NEUMAN and MARGARET W. NEUMAN. The University of Chicago Press, 5750 Ellis Avenue, Chicago 37, Illinois. 1958. xi + 209 pp. 14.5 × 22 cm. Price, \$5.00.

The Neumans have produced a book which will almost certainly furnish a center for crystallization of interest in the chemistry of the calcified tissues. The small group of devoted investigators in this field will now receive additional recruits as a result of the impact of this book on the minds of investigators who, heretofore, have not seen the calcified tissues as anything more than static stones. This monograph brings together not only a judicious summary of a vast array of observations, but assembles also the authors' sound interpretations and imaginative projections to the circumstances in living systems.

The book consists of seven chapters. The first chapter is a clearly written application of modern concepts of solution chemistry to calcium and phosphate ions as they exist in complex biological fluids. The second chapter deals in a precise and quantitative fashion with the interrelations of

the ion products in body fluids with the precipitation and dissolution of the bone mineral. The far reaching and significant biological implications of the supersaturation of body fluids with respect to the bone mineral are thoughtfully pointed out. The variable stoichiometry of the bone mineral within the apatite structure is reasonably explained in the third chapter by synthesizing three diverse concepts which have been separately championed. The fourth and fifth chapters deal mainly with the exchange and substitution of ions between the mineral and its fluid environment and with the influence of the crystal surface and of the ionic composition of its hydration shell on these processes. Practically all of the relevant studies with radioisotopes are brought together in these chapters to describe on a physico-chemical basis the turnover of the mineral ions of bone. The sixth chapter gives the observations and arguments to account for the mechanisms of parathyroid hormone and vitamin D actions through the effects of these substances in modifying bone cellular activity so as to alter the ionic composition of the fluid in intimate contact with the bone mineral crystals. The evidence for citrate as the metabolic product of the cells of importance in this regard is clearly presented. The final chapter describes a mechanism of calcification which excludes the necessity for a booster mechanism for producing a local increase of concentration of phosphate ions, *i.e.*, the Robison scheme of hydrolysis of phosphate esters by phosphate. The mechanism described involves the seeding of mineral crystal formation by the organic matrix of bone from the existing concentrations of calcium and phosphate ions in body fluids.

The volume is well printed and bound. Only one typographic error has been noted. The literature citations are ample and are correct, but they are inconveniently arranged by chapters as a separate section at the end of the book.

DEPARTMENT OF PHYSIOLOGICAL CHEMISTRY  
UNIVERSITY OF MINNESOTA  
MINNEAPOLIS 14, MINNESOTA

W. D. ARMSTRONG

**Interscience Monographs in Physics and Astronomy.**

Edited by R. E. MARSHAK, University of Rochester.  
**Volume 1: The Fundamental Constants of Physics.** E. RICHARD COHEN, Atomic International, A division of North American Aviation, Inc., Canoga Park, Calif., KENNETH M. CROWE, Radiation Laboratory, University of California, Berkeley, Calif., and JESSE W. M. DUMOND, Norman Bridge Laboratory of Physics, California Institute of Technology, Pasadena, Calif. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1957. xii + 287 pp. 16 × 23.5 cm. Price, \$7.50.

The title of this book is indeed an appropriate one with which to inaugurate a series of monographs in Physics and Astronomy. The authors are well known for their contributions to this field and have made manifestly evident their appreciation of their predecessor in this field, Prof. R. T. Birge, to whom the book is dedicated. Their philosophy and objectives are stated in the preface and in the first chapter titled Introduction. This is followed by seven chapters entitled: 2, Arbitrarily Defined Physical Units and Standards; 3, Classical Measured Constants and Units; 4, Masses of Atoms and Mesons; 5, History of the Atomic Constants; 6, Postwar High-Precision Measurements; 7, The Method of Least Squares; 8, Least Squares Adjustment of the Atomic Constants. Each chapter is followed by what seems a fairly complete set of references and there is an ample author and subject index.

In part, this reviewer found the book a vivid study in contrast. On the one hand there is exhibited a very critical approach in both the study of experiments and their analysis in the reduction of constants on what can be referred to as the "atomic scale," as contrasted to the treatment of physical parameters on the "nuclear scale," *e.g.*, the masses, lifetimes and properties of the various complex of mesons currently constituting the nuclear zoo. It is readily admitted of course that the latter field is currently rapidly developing and a really critical study would be difficult to carry through at the present time, but it would seem that some approach other than the mere listing of large numbers of experimental results with essentially no discussion, could have been arrived at. There does appear to this reviewer that there have been two serious omissions. Nowhere in the book does there appear any statement (or even an al-