pressed require the exercise of good judgment for their proper use.

Plainly, the reviewer of a *Gmelin* volume devoted mainly to chemistry is in difficulty—almost everything he can say has been said before. The present case is different. Germanium happens to be the first of the two elements that are making history as semiconductors. The book under review deals principally (pp. 132–454) with solid-state physics. Does the *Gmelin-Institut für Anorganische Chemie und Grenzgebiete* consider solid-state physics a *Grenzgebiet?* In any case, two colleagues expert in this field share my high opinion of what the *Institut* has done therein. The arrangement of the table of contents, a little puzzling on first glance, was clearly adopted because the overriding importance of the electrical properties of germanium could not have been foreseen when the 62-page *Hauptband* (sic!) appeared in 1931.

Where is inorganic chemistry going? Will it become the handmaiden of solid-state physics and similar disciplines? Which is more important, materials or processes? These are not idle questions, though it is idle to attempt answering them now. They are related to the *Grenzgebiet* problem raised above. Let us consider: Very roughly, 62 pages of "chemistry" in 1931 have grown to 254 pages in 1958. There have been added 322 pages on electrical properties, which cover the literature only to the end of 1954 although isolated later references appear. Work on germanium as a semi-conductor is still extensive. Beyond germanium, there is silicon; beyond silicon, a great many semi-conducting compounds. Where will it end?

Let us hope our friends the physicists will put the present volume to good use. If they do this, and refrain from compiling the same information for themselves, perhaps physicists and inorganic chemists will become so well acquainted that the questions of the previous paragraph will answer themselves.

RESEARCH LABORATORY
GENERAL ELECTRIC COMPANY HERMAN A. LIEBHAFSKY
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Effect of Surface on the Behaviour of Metals. Lectures Delivered at the Institution of Metallurgists Refresher Course, 1957. The Institution of Metallurgists. Philosophical Library, Inc., 15 East 50 Street, New York 16, N. Y. 1958. vii + 100 pp. 14 × 22 cm. Price, $10.00.

This small book comprises material originally presented in the form of lectures dealing with the effect of surface on the behavior of metals. These lectures were delivered for the Institution of Metallurgists at Llandudno during the annual refresher course in 1957. The first chapter by G. L. J. Bailey, entitled "Methods of Preparation and Examination of Surfaces," is concerned mainly with methods for studying the shape, composition and structure of surfaces both on a microscopic and atomic scale. Among other methods recent improvements in field-emission microscopes by Müller to yield resolutions of better than 3 Å. are cited, and also developments in the electron probe microanalyser. Beilby's flow theory of polish is considered to be considerably weakened by studies of Samuels on abrasion, polishing and etching which are discussed. The second chapter by T. P. Hoar, entitled the "Influence of Surface Treatments on the Chemical Behavior of Metals," stresses the importance of anodic processes occurring at the metal surface. The effects of mechanical work, and of electrochemical and chemical films of oxide, sulfide, and oxygen in passivation are considered. It is emphasized that pure surfaces are not obtained by electropolishing which can leave a protective film on the metal surface. The third chapter by F. T. Barwell entited "Relationship between Surface Condition, Friction and Wear" deals with the nature of frictional contact and the effect on it of temperature, and gases such as oxygen, hydrogen sulfide, water vapor, etc. Fretting corrosion, pitting, scuffing and wear of cutting tools, plain bearings and engine cylinder bore corrosion are briefly considered. Effects of artificially produced surface films of oxide, sulfide and phosphate are also discussed. Recent research has involved studies of the Russell Effect, The Kramer Effect, and Rehbinder Effect. The last chapter, by R. W. B. Stephens, entitled "Influence of Surface on the Physical Properties of Metals" makes a more mathematical approach to the nature and concept of a surface and presents a brief account of the free electron theory of metals. The importance of optical methods in surface investigation is stressed including polarimetric methods, and studies of the anomalous skin effect. The use of moiré fringe patterns in electron micrographs for the observation of dislocations is illustrated. Other subjects which receive attention are: electrical resistance, thermal properties, thermal contact coefficient, thermal accommodation coefficient, magnetic properties, thermomagnetic properties, galvanometric effects, and diffusion.

Because of the wide range of topics covered the treatment although for the most part excellent is of necessity brief. However, a good bibliography is appended to each chapter indicating where more detailed treatment is to be found. As is natural much of the material presented is of British origin although early work by Langmuir, and more recent studies by Gomer are cited. However, the excellent work of Gwathmey and associates is not mentioned. A number of excellent plates enhance the value of this text. It is believed that the audience to which this small book is addressed, and also others interested in the nature and properties of metallic surfaces, will find it a stimulating account of progress and recent advances in its field.

DEPARTMENT OF CHEMISTRY
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Fortschritte der Chemie Organischer Naturstoffe (Progress in the Chemistry of Organic Natural Products). Edited by L. ZECHMEISTER. Springer-Verlag, Mölkerbastei 5, Wien 1, Austria. 1958. vi + 244 pp. 16 × 23.5 cm. Price, $9.75.

This volume of the Fortschritte, one of two appearing at the same time, contains four essays, several of which are devoted largely to the work of a single group. Schlubach has surveyed the painstaking work at the Hamburg Staatsinstitut on the isolation and analysis of the polyfructosans of grasses, and summarizes the significance of carbohydrate metabolism in the problem of food production. Zechmeister presents a collection of miscellaneous studies on the dehydrogenation and isomerization of carotenoids, much of the material being taken from recent work in his laboratories. A description of the X-ray structural analysis of B_{12} by Dorothy Crowfoot Hodgkins gives an insight of this approach to complex structural problems, although the reader unfamiliar with the interpretation of electron density projections may have some difficulty in following the development of the structure. The very detailed and comprehensive account of the chemistry of podophyllum constituents by Hartwell and Schrecker is most representative of the definitive and critical reviews of a widely diverse literature for which this series is notable.

DEPARTMENT OF CHEMISTRY
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Pregl-Roth Quantitative Organische Mikroanalyse. Siebente, vollkommen neu bearbeitete und erweiterte auflage. By DR. H. ROTH, Badische Anilin- und Soda-Fabrik AG. Ludwigshafen A. Rhein Landwirtschaftliche Versuchsstation Limburgerhof/Pfalz. Springer-Verlag, Mölkerbastei 5, Wien 1, Austria. 1958. xiii +361 pp. 15.5 × 23.5 cm. Price, $11.85.

The seventh edition of the excellent book by Dr. Roth will make a valuable addition to libraries. It has been written in the same style as the previous editions. The book is divided into four sections.

The first section includes general information regarding microchemical balances, their use, and the auxiliary tools for handling and weighing samples and objects. Included here are also the preparation of standard solutions and the preparation of samples for analysis.

The second section of the book is devoted to the determination of the elements in the following order: carbon, hydrogen, oxygen, nitrogen, halogens, sulfur, selenium,

tellurium, phosphorus, barium, arsenic, antimony, boron, mercury, and metals in metallo-organic compounds. The material on the carbon and hydrogen determination includes the manual method of Pregl, as well as the automatic modifications. For the latter, emphasis is placed on the method of Zimmermann. The determination of oxygen is by the volumetric procedure of Unterzaucher. The determination of nitrogen is divided into three parts, the first describing the Dumas, the second, the Kjeldahl, and the third, the Lacourt hydrogenation methods. The first part emphasizes the Zimmermann modification of the Dumas–Pregl method. The Kjeldahl description includes a hydriodic acid pretreatment, either at atmospheric pressure or in a Carius tube, followed by kjeldahlization with sulfuric acid. For the determination of the halogens, a number of methods are described. For chlorine and bromine, these include catalytic combustion, Carius–Pregl, Kirsten and Schöniger procedures, as well as the Moser and Miksch simultaneous determination of the two elements. For iodine, the methods include the Leipert modification of the catalytic combustion and the Kainz potassium decomposition. For the determination of fluorine, decomposition with calcium hydroxide, perchloric acid distillation, and subsequent titration with thorium nitrate is described. In view of recent literature on the determination of fluorine, the method described by the author might not be expected to give reliable results with certain compounds, particularly the perfluoro ones. The material on the determination of sulfur includes both oxidation and reduction methods. Of the former, there are the Pregl and Zinneke catalytic, Carius and Schöniger combustions. The latter is a volumetric procedure based on the methods of Bürger and of Zimmermann. The determination of selenium is accomplished by an iodimetric procedure, based on that of Kainz, involving combustion in a bomb with sodium peroxide. Two procedures are given for phosphorus, the first being gravimetric, in which the element is determined as ammonium phosphomolybdate, and the second being colorimetric, the method of Roth, using the molybdenum blue reaction. Also included are the simultaneous determinations of barium, phosphorus and nitrogen. For arsenic, the Wintersteiner iodimetric procedure is described, for antimony, a bromide–bromate titration and for boron, a sodium hydroxide titration. Mercury is determined (a) by a Carius combustion, followed by titration with sodium diethyldithiocarbamate; (b) by decomposition in a carbon–hydrogen type combustion tube, followed by collection of the mercury as gold amalgam; and (c) by the electrolytic process. The determination of metals, in general, by the ashing technique is included as well as the electrolytic method for copper.

The third section of the book is devoted to the determination of various groups: C-methyl, isopropylidene, unsaturation, hydroxyl, active hydrogen, acetyl, benzoyl, alkoxyl, S-alkyl, carbonyl, peroxide, carboxyl, acid anhydride, lactone, saponification number, acid amide, amino acids, alkimide, primary amino groups, mercapto, disulfide and dialkyl sulfide, isocyanate and isothiocyanate, and dithiocarbamate and thiuram disulfide. The determinations of C-methyl and isopropylidene are according to the respective acidimetric and iodimetric methods of Kuhn and Roth. Both volumetric and manometric procedures are described for the determination of double bonds by means of hydrogenation. Triple bonds are determined by reaction with silver nitrate, followed by titration of the resulting acid. Hydroxyl groups are determined by means of either acetylation or the Karl Fischer reagent. Active hydrogen is determined by the Zerewitinoff (Grignard) method with reference to that which uses lithium aluminum hydride. Distillation in the apparatuses of either Schöniger, Lieb, and El Din Ibrahim or Roth is recommended for the acetyl (benzoyl) determinations. Alkoxyl (S-methyl) is analyzed in the classic Pregl apparatus, except for very volatile substances for which the Furter set-up is recommended. The simultaneous determination of methoxyl and ethoxyl is still performed by the method of Küster and Maag. The literature reference number 3 on page 254 in connection with the above is incorrect. The reference should read "*Z. physiol. Chem.*, **127**, 190 (1923)." Propoxyl and butoxyl determinations are carried out using the Shaw apparatus. The basis for the vinyl ether determination is the Siggia and Edsberg iodine addition method. Carbonyl is determined by reaction with 2,4-dinitrophenylhydrazine, reduction of the dinitrophenylhydrazone to the diamino compound with an excess of titanium trichloride and subsequent titration of the excess with standard ferric ammonium sulfate. Peroxide is determined iodimetrically by the method of Roth and Schuster. Various procedures of titration with alkali are used for carboxyl (neutralization equivalent), acid anhydrides and lactones. The acid anhydrides are also determined indirectly after reacting with 2,4-dichloroaniline. The sodium salt of triphenyl-*p*-rosanilinesulfonic acid is used as indicator for the determination of saponification number, while methyl red is used for acid amides. Four methods are described for α-aminoacids: (a) titration with alkali, using thymolphthalein as indicator; (b) by the ninhydrin (triketohydrindene hydrate) reaction; (c) by the perinaphthidan-2,3,4-trione hydrate reaction, and (d) by the Van Slyke volumetric procedure. Besides the Van Slyke apparatus, that of Kainz is used for amino groups. It is attached to a regulation micronitrometer. Two procedures are described for alkimide groups, namely, the gravimetric and the volumetric (iodimetric). The apparatus employed is that described by Sirotenko. Mercapto (sulfhydril) groups are determined by oxidation with iodine or by reaction with cupric salts. Disulfides and dialkyl sulfides (thioethers) are determined iodimetrically. Isocyanates and isothiocyanates are treated with amines to give alkyl derivatives of urea and thioureau, respectively. Dithiocarbamates and thiuram disulfides are determined iodimetrically by the method of Roth and Beck.

The fourth section of the book is devoted to the determination of physical constants. Included are determination of melting point, boiling point, molecular weight, optical rotation and molecular refraction. Considerable space is devoted to the determination of melting points by means of the Kofler micro hot-stage. The boiling point determination is a modification of the method of Schleiermacher which gives the value at 760 mm. pressure. Two methods for molecular weight are described, namely, the Rast melting point lowering and the Barger osmotic (isothermal distillation). In connection with the former, 27 compounds are listed which are suitable as solvents. Optical rotation is done by the method of Fischer. A special precision weighing pipet is used for the molecular refraction determination. The last eight pages of the section are devoted to calculations and tables of factors. Included is a table of factors for the Dumas nitrogen determination, covering the ranges of temperatures from 10 to 30° and pressures from 700 to 760 mm.

In general, the illustrations are the same type that Dr. Roth (and Pregl) used in previous editions. In the opinion of the reviewer, it would have been far more preferable to have used fully dimensioned drawings (of the type published by the Committee on Microchemical Apparatus of the Division of Analytical Chemistry of the American Chemical Society or by the British Standards Institution) which would have made it possible for anyone to correctly manufacture the various pieces of apparatus. With this exception, Dr. Roth's book is an extremely valuable contribution to the literature of the field.

MICROCHEMICAL DEPARTMENT
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Growth and Perfection of Crystals. Proceedings of an International Conference on Crystal Growth held at Cooperstown, New York, on August 27–29, 1958. Sponsored by Air Force Office of Scientific Research, Air Research and Development Command and The General Electric Research Laboratory. Edited by R. H. DOREMUS, B. W. ROBERTS and DAVID TURNBULL. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1958. xviii + 609 pp. 22 × 28.5 cm. Price, $12.50.

In less than ten years, three conferences (two of which were international) have been held on current research in the general field of crystal growth: in 1949, sponsored by the Faraday Society; in 1956, sponsored by the USSR Academy of Sciences; in 1958, sponsored by the United States Air Force and the General Electric Company. Full reports of these conferences have been made available; the last is the subject of this review. In addition, the comprehensive book by H. E. Buckley appeared in 1951.

Following an introductory lecture, the conference report