even for those who know a little bit about very low and very high temperatures. However, sections 1 and 5 are less enjoyable. Especially the introduction of the Kelvin temperature scale without even mentioning Gay-Lussac's law of 1802, makes it difficult to understand the arrival at the absolute zero point. If the author thinks that Gay-Lussac's experiments are too elementary, why then does he mention other simple things in the book? For instance, on page 47 he explains what a sodium ion is. There is also some misleading information, for example on page 8, ". . . the optical pyrometer may be used at temperatures above the melting points of metals" (!). We know that there are metals which melt at 156°, 30°, and even at −39°C.

Only elementary mathematics is used in the book; and the derivations of some equations, for example that of Boltzmann (pages 31-35) and that of Planck (pages 83-85), are given. Nevertheless, the reviewer disagrees with the opinion of the author (see preface) that the book can be used by a high-school student, especially as we know that one can graduate from high school without taking any course in chemistry or physics. The book could be useful only for those who already have some good knowledge in physics.

Physical Acoustics, Principles and Methods. Volume 2, Part B, Properties of Polymers and Nonlinear Acoustics. Warren P. Mason, ed. 383 pp. Academic, New York, 1965. $14.00.
Reviewed by Walter G. Mayer, Georgetown University.

The detailed description of relaxation processes, which formed the main theme of Part A of the second volume (*Physics Today*, September 1965, p. 74), is concluded in Part B. The first three chapters are concerned with relaxation in various forms of polymers and to some extent with its relation to physical acoustics. The first section (W. Philippoff) treats shear deformation in polymer liquids and gels, and only the harmonic aspects of stressing are considered in terms of acoustics. The next two chapters on relaxation in solid polymers and glasses (I. L. Hopkins and J. E. McKinney) concentrate on physical chemistry and the mechanical behavior of these polymers. These sections leave the realm of acoustics to some extent but the authors appear to be aware of this departure, judging from a statement in Chapter 8: "We are not overly concerned by this, particularly since we have never found any wide agreement on the definition of 'acoustics'."

Re-entry into the more familiar atmosphere of "acoustics" takes place by means of a rather brief chapter on nonlinear acoustics (R. T. Beyer). This section gives a description of the various parameters that lead to harmonic distortion of an initially sinusoidal wave. A number of experimental verifications is given here with more emphasis on results than on experimental methods. The application of optical methods, that is, light diffraction by ultrasonic waves, to problems of nonlinearity in liquids is treated in the first part of the last chapter (L. E. Hargrove). These two sections on nonlinear acoustics present a well rounded treatment of finite amplitude distortion in liquids.

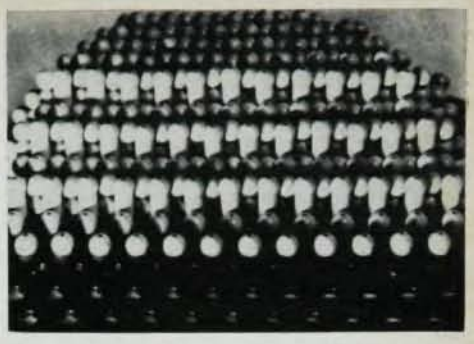
The second part of the last chapter (K. Achyuthan) deals with optic-ultrasonic methods in determination of photoelastic constants of solids.

Finally, the book contains a section on acoustics streaming (W. L. Nyborg) which presents much more information on this particular subject, both theory and experiment, than one finds in the usual textbook.

Every chapter is written with the authority and clarity that one now expects to find in every new volume of this series. Anybody who has appreciated the contents of the previous volumes will not be disappointed with this book.

An Atlas of Models of Crystal Surfaces. By John F. Nicholas, 229 pp. Gordon and Breach, New York, 1965. $27.50.
Reviewed by H. M. Otte, Martin Co.

At the list price this book is a horrendous overindulgence by the publishers. The volume is one of a series of eclectic books gathered under the title of Materials Science and Engineering Program for which J. [F.] Nicholas is listed as an associate editor. One is tempted to inquire whether, in that position, he is at the mercy of the publishers, or in cahoots with them. In either case, the result is to make the dissemination of whatever useful information may be contained in this atlas so prohibitively expensive as to question whether there is in fact any desire to communicate with fellow scientists or merely with bibliophiles. The book is most attractively produced.



Model of diamond (311). From: An Atlas of Models of Crystal Structures.

"An Illustrated Catalogue of Selected Models of Crystal Surfaces" would be a more apt description of the contents. A total of 191 halftone photographs (4½ × 6 inches) have been assembled under one cover together with a 21-page explanatory and descriptive introduction written primarily for the practising surface chemist or physicist. The introduction summarizes not only the mathematical foundations for calculating the positions of atoms on "atomically-flat surfaces" but also the construction of the models. For details the reader is referred to several publications by the author.

In the FCC, BCC, NaCl and diamond structures 22 surfaces, ranging from the (100) to the (851) were photographed. For the FCC and BCC this was done with the surfaces in two orientations, one with reference to the (100) plane and the other with reference to the (111). For the NaCl, the diamond, and the HCP structures the surfaces were recorded in only one orientation; however for certain hkl, two possible surfaces could exist, and in this case both were photographed. Thus there are 44 photographs for each of the FCC and BCC structures, 27 for NaCl, 33 for diamond and 43 for HCP. (For

some unexplained reason, seven pages have been left blank, apparently at random through the book.) Under each photograph is a drawing of the basic atom positions and the crystal axes, as well as a table of the atomic positions. This is undoubtedly the most useful part of the book.

The primary aim of this publication, according to the author, has been to provide those interested in flat surfaces with enough information to save them from constructing models for themselves. I wonder how many investigators with this interest would in fact find the photographs sufficient. Dr. Nicholas therefore also provides brief details of how the models were made, and cautions the reader (or user) in applying the information to real surfaces, where relaxation of the surface atoms may occur or where other surface imperfections may be present. One is thus immediately on guard as to the extent that the photographs and models can be usefully applied.

Although reference is made to the possible use crystallographers may have for these photographs and diagrams, it is likely to be very limited because of the select few surfaces that have been, out of practical consideration, constructed and photographed. There may, however, be some workers who will be grateful to the authors and the publishers for their effort in assembling and compiling this atlas. For them this book will be a real and helpful contribution in the field, even at the listed price.

Investigations into Electrical Discharges in Gases. B. N. Klyarfel'd, ed. Transl. from Russian by D. Cossutta. Transl. edited by T. R. Foord. 283 pp. Pergamon, Oxford, 1964. $12.00.
Reviewed by Sanborn C. Brown, Massachusetts Institute of Technology.

One might be led to believe from the title of this volume that it was a general book on gaseous electronics. This is very far from the case, and yet it is difficult to assign any particular homogeneity to its contents. The papers were presented at a symposium and published as a book in Moscow in 1958. Eight of the twelve papers were parts of the authors' theses and most of the work is based on the literature of the 1930's and 1940's. Three main topics that are discussed are directed primarily toward an understanding of high-voltage rectification in a mercury arc. The papers can be grouped around the problems of low-pressure arc breakdown, the effects of mercury droplets at the cathode surface, and methods of gas-density measurements in a mercury-arc rectifier.

The book will be of interest to those especially oriented toward the problems of high-voltage rectification associated with mercury-arc rectifiers, but it can in no way be considered a scholarly contribution to the literature of electrical discharges in gases.

Collision Phenomena in Ionized Gases. By Earl W. McDaniel. 775 pp. John Wiley & Sons, Inc., New York, 1964. $17.50.
Reviewed by Ernest P. Gray, Applied Physics Laboratory, The Johns Hopkins University.

All of us who deal with ionized gases, novice and expert alike, should rejoice at the publication of McDaniel's new book. Here under a single cover is a mammoth compendium of almost every important fact about collision phenomena in ionized gases, logically organized into a well defined discipline, extensively indexed and exhaustively referenced, lucidly explained in physical and mathematical terms, and adequately supplemented with the background material needed by those whose prior knowledge may be insufficient. Within the scope of the book, which deals only with noncollective processes in ionized gases, the treatment is well nigh encyclopedic. Almost every conceivable aspect of every possible process is at least mentioned and every important reference is likely to be cited.

The book is described in the preface as having evolved from a set of notes used by the author in seven years of teaching plasma physics and gaseous electronics in the Physics and Electrical Engineering Department of the Georgia Institute of Technology. This is undoubtedly why McDaniel has retained an excellent chapter of background information from the kinetic theory of gases, and why he occasionally stops in his tracks to explain fundamental physical facts which might have been taken for granted (for example, that classical physics fails to give an accurate description of collision processes on the atomic scale). Despite these concessions to the reader with a meagre physics background, however, the resulting book is far more successful as a monograph than as a text. In this reviewer's opinion it is likely to become a standard reference, an updated version, as it were, of Massey and Burhop's definitive work on the same subject written nearly fifteen years ago.

Of particular merit is McDaniel's exhaustive and detailed description of experimental work. The motivation and virtues of each experiment are clearly stated, the experimental difficulties and limitations are fully appreciated, and the meaning and implications of the results are always indicated. By comparison, the discussion of the theoretical material, although reasonably complete and perfectly sound, is perhaps more conventional, often following the well-known lines of such old standbys as Mott and Massey's *Theory of Atomic Collisions* and others. For example, the discussion of as important a subject as the Born approximation provides no new insight and is somewhat pallid in contrast to the fresh and lucid treatment that makes most of the book such a pleasure to read. Perhaps the most valuable chapters of the book are those devoted to inelastic collisions between heavy particles, the mobility of gaseous ions, the diffusion of electrons and ions, electronic energy distributions and drift velocities, and recombination. Some of this material appears in no other book, and the rest is more fully and clearly treated here than elsewhere. Also outstanding is the closely knit organization of a subject matter that is by nature highly fragmented.

To keep the size of the book within reasonable bounds, McDaniel has quite properly concentrated his major attention on work undertaken during the past ten or fifteen years, after publication of Massey and Burhop's book. Work covered there is sometimes described only briefly in the present volume, with reference to the lengthier treatment.

The format of the book is very