measurement and calibration are outlined in the second chapter. Writing this chapter must have been difficult for it is in just these aspects of the subject that progress has been most apparent but where uncertainties related to the development of a pressure scale are also much in evidence. For example, although pressures obtained in the laboratory now approach 500 kilobars, Bridgman's widely accepted value for the freezing pressure of mercury, which has been the secondary standard for the calibration of resistance gages, has been reexamined and found to be about 1 percent too low. An average of the results obtained for this important point by five groups using the free piston balance for absolute calibration establishes it as 7566 ± 4 bars at 0°C. Fixed points on the pressure scale up to 100 kilobars for which there is general consensus are: Bi I–Bi II at 25.40 ± .08 kilobars, Tl II–Tl III at 37.1 ± 0.1 kilobars, and the barium point at about 59 kilobars. Above 100 kilobars calibration becomes increasingly difficult and uncertain.

The major part of volume 1 is devoted to the properties of matter in the gaseous, liquid, and solid states. Chapter 3 is concerned with the special techniques that are needed for handling gases at high pressures and with the measurement of equilibrium, transport, and spectroscopic properties. Similar aspects of liquids are considered in chapter 4; water, because of its unusual properties (for example, decreasing viscosity with increasing pressure), receives particular attention. Various approaches to the derivation of equations of state are reviewed as an introduction to the subject of solids, including the theory of finite strains, the Grüneisen relation, Debye's theory of specific heats, and the Lindemann and Simon equations for melting. Equations of state for extremely high pressures may be derived from the Thomas-Fermi model, assuming a continuous distribution of electronic charge density and applying a temperature perturbation to obtain the thermodynamic state functions. Electron exchange interaction and spin correlation are ignored in this approximation, leading to positive errors for the energy of the system. Correction for these terms leads to equations of state which approach validity for pressures in the neighborhood of 10^4 kilobars for elements of high atomic number. An excellent discussion of phase changes is given, including the anomalous melting behavior of He^3. At about 0.3°K, dP/dT passes through zero and the entropy of solid He^3 exceeds that of the liquid below this temperature. Paradoxically, this means that liquid solidifies on heating at constant pressure below 0.3°K! Other topics include the effect of pressure on diffusion in solids, the electrical properties of normal metals and semiconductors, and superconductivity. The transition temperature of most superconducting metals is lowered by pressure, although thallium, bismuth, and some alloys display anomalous presssure dependence. The discussion of the optical behavior of solids under pressure is particularly interesting. The ultraviolet absorption edges of ionic and molecular compounds typically exhibit a red shift with pressure, but the behavior of germanium and some of the III–V semiconductors is more complex.

The same high standards are maintained in volume 2, which opens with a comprehensive survey of the geochemical applications of high-pressure research. The consideration of chemical equilibrium in gases and liquids is followed by an interesting discussion of chemical kinetics based upon transition state theory, with experimental results drawn from diffusion-controlled reactions and reactions that involve molecules and ions. The theory of shock waves is developed in chapter 9, with an excellent treatment of measurement techniques and applications to a variety phase transitions in metals and compounds. The wealth of information revealed by magnetic resonance investigations at high pressure is recounted in chapter 10. Chemical shifts in the zero field nuclear resonance of Fe^{57} are a linear function of pressure and may be useful for pressure calibration. Variation of the nuclear spin-spin relaxation time with pressure in solid hydrogen, in aliphatic compounds and in alkali metals, have yielded valuable information on their diffusional motions. Nuclear quadrupole resonance studies in certain molecular compounds indicate negative Grüneisen coefficients (decreasing lattice vibrational frequency with increasing pressure), contrary to normal behavior in solids. The direct examination of phase transitions by means of x-ray diffraction measurements is outlined in chapter 10; although it is a comparatively old technique, the use of diamond anvils during the last decade has greatly extended the range of accessible pressures.

This excellent treatise is especially welcome at the present time, for research in the properties of matter under very high pressures is undergoing its most vigorous development.

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History of Pharmacy

Kremers and Urdang's History of Pharmacy. Revised by Glenn Sonnedecker. Lippincott, Philadelphia, ed. 3, 1963. xii + 464 pp. Illus.

Seldom does the revision of a book do so much to enhance its physical appearance and utility. Changing the format to a two-column page and using numerous subheads as well as the usual division heads, combined with the addition of many attractive and pertinent illustrations, has produced a book in which each page seems to cry out, "Read me!"

Although it has long been a classic in its field, the original Kremers and Urdang "reference and text" left something to be desired. In this third edition the faults have been corrected. The number of illustrations and figures has more than tripled. These excellently reproduced illustrations breathe life into the printed words and contribute immeasurably to the instructional value of the book. It is indeed refreshing to find a volume that can be used as either a reference or a textbook without one aspect overshadowing the other.

The arrangement is essentially the same as that used in the second edition. The ancient and medieval antecedents of pharmacy are covered in the first part, while pharmacy in Europe from the Renaissance to modern times is developed in the second. The development of the profession in the United States is thoroughly covered in the third part. The chapters that deal with American associations, legal standards, education, and literature have been enlarged and brought up to the minute. Contributions made by pharmacists to society are considered in the final part. The splendid glossary and the bibliographical notes have been brought up to date. Welcome additions are the appendixes in which are listed drugs used by the American Indians, the founding

dates of state pharmaceutical associations and schools of pharmacy, the dates on which laws concerned with pharmacy were passed (in the U.S.), publications of the American Pharmaceutical Association, and museums of pharmacy throughout the world.

Hitherto the book has been useful in the classroom and in pharmaceutical and science libraries. This revision not only fills the same roles, but will also be useful in public libraries as a source of information on pharmacy for the layman and in high school libraries as a service to interested upperclassmen and their guidance counselors.

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The Solvay Congresses

The Quantum Theory of Fields. Proceedings of the conference held at the University of Brussels, October 1961. Stoops, Brussels; Interscience, (Wiley), New York, 1963. 261 pp. Illus. $8.

This is the report on the 1961 Solvay Congress, the 50th anniversary of the first Solvay Congress. The subject of the conference was, perhaps, more general than those of the most recent Solvay congresses, and perhaps even more general than the title indicates: it encompassed the most important developments of the last few years on the frontiers of modern theoretical physics.

The outward organization of the congresses has changed little throughout the years: addresses by "rapporteurs" are followed by a general discussion. This conference had a galaxy of reporters—Bohr, Heitler, Feynman, Pais, Gell-Mann, Källén, Goldberger, Mandelstam, and Yukawa. The number of participants was also greater than usual, even though the increase in their number did not keep pace with the increase in the number of physicists throughout the world. In addition to the reporters, there were nine members from the United States, three from Great Britain, and one each from Denmark, Germany, Italy, Japan, Sweden, and Switzerland. Members of the secretarial staff and the official "auditeurs" participated in some of the discussions. Three Russians were invited but could not come.

If the outward form of the conference was very similar to that of the early congresses, the spirit of the conference did undergo radical changes. This fact emerged most clearly from Bohr's colorful introductory report in which he reviewed the earlier conferences in a somewhat nostalgic but most fascinating address. His report on the first few conferences, though he did not attend them, is just as vivid and charming as that of the later ones at which he had a leading part. At the early conferences, all participants were familiar with the work of all other participants—they formed a single family intellectually. At present, it is hard to find anyone who can fully appreciate all parts of all the reports, even though personal contact among participants is more frequent. However, this greater intellectual distance between participants made the conference more exciting and also made the report—this book—more useful. Earlier Solvay reports had as much human as scientific interest; the present one, while not diminished in human interest, is also scientifically a most useful volume, one that I have already seen in the hands of several colleagues.

The reports vary a great deal in character and sophistication, and it is not possible to review all of them. I particularly enjoyed reading the contributions of Feynman, Pais, and Gell-Mann—perhaps because I was more familiar with the subjects of the other contributions.

Feynman's contribution has two parts. The first is a sketchy but instructive description of the way concrete results are obtained from quantum electrodynamics. The results are compared with experiments in order to assess the validity of quantum electrodynamics. The possible deviations are expressed as modifications of the propagator, and it is concluded that such modifications, if any, are not appreciable below an energy of 600 Mev. The second part of Feynman's contribution is a stimulating analysis of the foundations of quantum electrodynamics and its conceptual limitations. This is the most interesting part of the review, and it also contains brief reference to dispersion theory. It is not everywhere easy to follow, and I also had my difficulties. The report is studded with delightful apercus, such as the following: "No problem can be solved without dragging in its wake new problems to be solved. But the incompleteness of our present view of quantum electrodynamics, although presenting us with the most interesting challenges, should not blind us to the enormous progress that has been made. With the exception of gravitation and radioactivity, all of the phenomena known to physicists and chemists in 1911 have their ultimate explanation in the laws of quantum electrodynamics."

Pais presents a splendid review of our state of knowledge concerning weak interactions, with particular emphasis on accurate and approximate invariances. He divides the processes induced by weak interactions into three groups. The processes of the first group result in a pair of *leptons*, that is electrons, neutrinos, or μ-mesons. The decays of the second category also result in a pair of leptons, but the decaying particle undergoes a greater change than in the processes of the first category: their "strangeness" changes. The processes of the third category do not produce a pair of leptons but a strongly interacting meson, such as a π. Pais discusses the experimental material concerned with each of the groups of processes and also the validity of the various invariance principles for them. Although his report reaches the boundaries of our knowledge, it could also serve as an introduction for the less initiated.

Symmetries are the theme of Gell-Mann's discussion. He mentions all the precise symmetries that we know, as well as charge, baryon (that is, heavy particle), and lepton conservation. He considers the approximate conservation laws as implying particularly simple equal time commutation relations—a view that surely needs further elaboration but one which will be most fruitful if confirmed.

In summary, this book reports on a very stimulating conference in a most stimulating fashion. It is a pleasure to read, and I enjoyed virtually all parts of it—but at times it was a strenuous pleasure.

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Principles and Applications

Mass Spectrometry. Charles A. McDowell, Ed. McGraw-Hill, New York, 1963. xii + 639 pp. Illus. $20.

As science continues to become more specialized, it is increasingly more common and understandable that books are "edited by" rather than written by one