Chapter 9, on the identification of spectrum lines, measurement of wavelengths, and the determination of minute traces of impurities with the comparator, closes with a description of Harrison's remarkable automatic comparator, used at the Massachusetts Institute of Technology since 1938. This machine is capable of measuring in two minutes a spectrum plate 20 inches long on which are recorded as many as 2,000 spectrum lines. It records on a motion picture film, to seven-figure precision, the wavelengths in Angstrom units of all of the lines, along with a curve of density showing their position and intensity. Unfortunately, the record on the strip of film reproduced is on such a small scale that the numerals can't be read. This is also the trouble on page 163 in the case of the sensitivity curves of various emulsions.

Chapter 10 covers very fully the modern quantum theories of atomic spectral series, energy levels, and the Zeeman and Stark effects (the former effect furnishes a method of classifying lines into series). The chapter closes with a treatment of the Pauli exclusion principle and the periodic table.

Chapter 11 is devoted to describing the highly complicated fine structure of the spectra of molecules (their rotation and the vibration of their atoms give rise to corresponding energy levels, superposed on the electronic levels), and to explaining the part these energy levels play in producing various types of absorption spectra.

In Chapters 12 to 14 we are back again in the laboratory with 420 pages devoted to methods for measuring the intensities of spectrum lines or absorption bands by means of radiometers, photoelectric cells, and photographic emulsions. Some of the instruments are automatic, like the extremely complicated photoelectric spectrophotometer of Hardy, and the instrument of Harrison and Bently previously mentioned.

Chapters 15 and 16 deal with the qualitative and quantitative analyses of materials. In the two following chapters the treatment of infrared and "Raman" spectroscopy is far more extensive than is usual in books on general spectroscopy, and Dr. Lord's contrast and comparison of these two types of observation will be of great interest to everyone engaged in the study of molecular structure and in qualitative and quantitative chemical analyses.

A minor mistake was made on page 474 in crediting E. F. Nichols with the invention of the widely used method of residual rays, and not mentioning Rubens, who originated the method and named the radiations "rest strahlen." Nichols, who was working under the direction of Rubens, had found that a quartz plate had a very high coefficient of reflection in the region between 8 and 10 microns, but it was Rubens who foresaw that multiple reflections from a number of plates would eliminate all of the very intense radiations of shorter wavelength. Rubens developed the method and published it under joint authorship with Nichols. The description of the method of "focal isolation" of a narrow region in the remote infrared (described on the next page) omits mention of the very essential circular metal disk covering the center of the quartz lens or the fact that two such lenses are usually employed.

Chapter 19 covers the spectroscopy of the vacuum ultraviolet and presents diagrams of the vacuum chambers housing the optical parts. The final chapter offers a much longer treatment of interferometric spectroscopy than is usual in textbooks, covering the Lummer Gehrcke plate, Fabry and Perot's etalon, the Michelson transmission echelon, and the reflecting one of W. E. Williams.

The very complete references to specific points, in the form of footnotes, and the general references at the end of the chapters supply the details, often desired, but usually found wanting in a book like this, for lack of space.

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Handbook of radioactivity and tracer methodology. William Siri. (With contributions by Ellsworth C. Dougherty, *et al.*) (Air Force Technical Report No. 5669.) Washington, D. C.: Office of Technical Services, Department of Commerce, 1948. Pp. 867. (Illustrated.) $20.00.

This handbook should be an invaluable aid to the many scientific specialists who wish to apply the use of radioactive or stable isotopes to the investigation of their special interest. I should say that it would be particularly useful to the biologist or chemist who needs these techniques but who has been handicapped by a lack of information about the physical methods which must necessarily be used for measurement of the appropriate rare isotope. Such an individual will find the necessary background information on nuclear physics in the first section of this handbook. This section also contains a wealth of range and cross section data which will be of particular interest to the physicist or biophysicist. The second section of the handbook is devoted to a discussion of the various instruments used for measurement of isotopes. The information in the chapter on calibration and use of G-M counters, as well as the detailed discussion on preparing biological samples for counting, is indispensable to the novice and probably could be read with profit by many of the more experienced workers in the field. The chapter on autoradiography is somewhat general and, in view of the rapidly expanding interest in this technique, the next edition of the handbook should perhaps treat it in greater detail.

A third section deals with the biological and medical applications of isotopes. The useful isotopes are discussed as regards their use in both tracer experiments and therapeutic applications. A chapter on the biological effects of natural radioactive elements closes this section.

The fourth section consists of an extensive bibliography including some general references and a complete list arranged according to the elements investigated.

In general it may be said that this handbook contains information available in no other single source. While particular stress has been laid on its usefulness to the biologist or chemist, it should be an invaluable reference

for the graduate student in physics or biophysics as well.

The one respect in which this book fails to qualify as a bible for the beginner in radioisotopic research is its lack of a health physics section. This may be a calculated omission, based on the belief that the biologist or chemist must associate himself with a specialist in health physics if he wishes to avoid serious health hazards. However proper this attitude may be, and regardless of who makes the radiation measurements, it is the duty of any responsible investigator to inform himself about the radioactive hazards he and his subordinates might incur in carrying out their work. The widely spread use of radioactive isotopes may result in injurious radiation exposure if sufficient background information on health physics is not generally available. If this handbook becomes as widely distributed as its excellence deserves, it might well serve to supply this basic health physics information.

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Some aspects of the luminescence of solids. F. A. Kröger. New York-Amsterdam-London: Elsevier Publ., 1948. Pp. xi + 310. (Illustrated.) $5.50.

Although the war ended almost four years ago, conditions insuring an easy access and exchange of available scientific information have not yet returned. A great amount of valuable research has been done in some European countries during and after the war. However, because of the limited availability and circulation of European journals, the results of these researches are not widely known in this country. It is fortunate indeed that Dr. Kröger, who has contributed so much to the knowledge of the luminescence of solids, undertook the task of presenting in this monograph the results of his experimental researches and combining them with a critical review of the existing theories of the luminescence processes in solids. Dr. Kröger's association with one of the leading industrial laboratories,—the Philips Laboratories in Eindhoven, Holland—has enabled him to use freely all the rich resources of information amassed there in the course of many years of research.

The first chapter discusses schemes of energy levels for pure solids and for solids with lattices disturbed by the presence of impurities. A more detailed description is given of the atomic orbit approximation for the case of ionic lattices. Other topics are the processes of light absorption and emission, and the nature of metastable states of the activation, sensitization, and energy transfers through the lattice. Finally, a classification of all known luminescences of activated phosphors is attempted in the form of tables accompanied by very exhaustive references to original papers. The next four chapters consist of results of experimental work on particular systems—tungstates, molybdates, and luminophors activated by manganese, uranium, and titanium. The skillful identification of the tetravalent manganese ion as activator for the emission of a red band (Chapter II), and the correlation between the positions of the absorption edge and the maximum of the emission for tungstates and molybdates (Chapter III) are especially interesting. The sixth and final chapter compares the experimental results on the influence of temperature on efficiency of luminescence with the explanations of the quenching processes proposed by Mott and Seitz, Möglich and Rompe, and Klasens and Schön. It is shown that in some cases the excitation energy is directly transformed into vibrational energy (Mott-Seitz), in others the energy is dissipated via intermediate states (Klasens-Schön). A useful table of classification for all known types of temperature quenching is included. An appendix provides a few data on experimental techniques.

In general, the monograph is both interesting and informative. Great care has been exercised in both theoretical chapters to present a clear picture of the processes in solid luminophors and to establish a well-defined terminology for these processes. One section seems a little too condensed and could benefit by some additional explanations. This section deals with the energy level scheme. The use of expressions like "energy cost" (energy requirement) and "cheap transition" (low frequency transition), which are probably the result of a too-literal translation from Dutch into English, is unfortunate. In other respects the book is very readable and the reviewer feels that it fills an important gap in the literature on luminescence of solids. The successful effort made by Dr. Kröger to organize a considerable number of previously uncoordinated facts and correlate them with corresponding theoretical considerations is especially welcome in a field of physics where the richness of experimental data seems to be in contrast to the meagerness of our understanding of fundamental processes.

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Vision and the eye. M. H. Pirenne. London, W.C.1, Engl.: Pilot Press, 1948. Pp. xx + 187. (Illustrated.) 12/6.

As noted in the foreword by W. S. Stiles of the National Physical Laboratory of England, this little book offers a treatment of selected topics in vision rather than an attempt to cover the entire field in its many ramifications. The subjects selected for treatment are apparently those in which the author has done research and made scientific contributions; this makes the book particularly authoritative and forceful.

The first five chapters discuss in detail the several phenomena involved in image formation by the eye, from the physical and physiological points of view. A lengthy treatment follows of questions relating to the way in which the particle or quantum nature of light enters as a factor in determining visual response, and the experiments of Hecht, Shlaer, and Pirenne are quoted and discussed in detail. The final third of the book is devoted to the subject of color vision, except for a single chapter which relates to binocular vision.

It is hard to see exactly what audience the author had in mind for this book, since some portions seem elemen-