gram for studying radiation methods is underway in the Bureau's high-temperature laboratory. The basic data required include a knowledge of the energy levels of the various molecules, free radicals, and atoms that occur in hot gases and flames, the transition probabilities, and the line widths. Three phases of the program are currently being investigated. These are (1) the study of the relative intensities of lines in the visible and ultraviolet spectra of simple flames, (2) the determination of transition probabilities and line widths under conditions of thermal equilibrium, and (3) the analysis of infrared spectra of flames and the investigation of methods of determining temperatures from them.

At low temperatures (below 90°K) NBS research on thermometry has two major objectives: first, the determination of thermodynamic temperatures by means of a gas thermometer and, second, the development of convenient, sensitive, and reproducible secondary thermometers which can be calibrated by means of the gas thermometer. Resistance thermometers constructed of the semiconducting elements, silicon and germanium, have proved to be extremely sensitive. While satisfactory reproducibility still remains a problem, results of initial tests have been quite promising.

Temperatures in the range from approximately 4° to 1°K are obtained by controlling the pressure on a bath of liquid helium, and the relation between the vapor pressure of helium and the temperature is used to determine temperatures. Below this range, another method of both attaining and measuring temperatures must be used (the lowest limit attained by reducing the pressure on the helium is approximately 0.7°K). The method of adiabatic demagnetization of paramagnetic salts proposed by Giauque and Debye in 1926 is used to achieve these low temperatures. During the past year, equipment has been constructed and installed at NBS which is designed to permit investigation of the properties of these paramagnetic salts which serve as low-temperature thermometers. No effort has been made to set a low-temperature record, but the paramagnetic salt has been used to cool liquid helium to 0.02°K in order to investigate its properties at these extremely low temperatures.

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Books

Electronic and Ionic Impact Phenomena. By H. S. W. Massey and E. H. S. Burhop. 669 pp. Oxford University Press, London, England, 1952.

At a time when interest in electronic and ionic phenomena in gases is on the increase, this compendious and authoritative volume is most welcome. Here at last is a review of the experimental results and an outline of the theoretical calculations in the field of electronic and ionic collisions done the past thirty-odd years, presented in readable form by two authorities in the subject.

The large amount of material is organized logically, starting with electronic impacts with atoms, the measurement of total cross sections, then the results for elastic and inelastic impacts; this quarter of the book terminating with an outline of the quantum theory of such collisions and a comparison between theory and measurements. After a similar discussion of electronic collisions with molecules there is a chapter on electron impacts with surfaces of solids and one on electronic collisions involving radiation, bremstrahlung, etc. Next comes a chapter on the collision between atoms and one on the passage of ionic or atomic beams through gases. Finally there are chapters on the impact of ions and atoms on surfaces and on recombinations.

The book appears quite complete in its coverage of these complex phenomena. The references to the original papers seem to be inclusive. There are several bibliographies on special subjects and an adequate author and subject index. The volume will be a necessity to anyone working in this field.

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Civil Defense in Modern War. By Augustin M. Prentiss. 429 pp. McGraw-Hill Book Company, Inc., New York, 1951. $6.00.

Civil defense, although long recognized as a necessity in countries which have undergone aerial attacks, was until very recently considered virtually an academic issue in the United States. The appalling vulnerability of our cities and industrial centers to modern bombing planes and guided missiles capable of delivering atomic bombs is painfully evident at the present time, however, and as a result progress is being made toward the establishment of an effective civil defense program. A great deal of information both on what is to be expected from modern weapons and on how to combat their effects is presented in *Civil Defense in Modern War*. In the words of General Prentiss, the purpose of the book