field gradients from pure nuclear quadrupole resonance), and with relaxation effects (diffusion in alkali metals and hindered rotation in molecular solids) that are characterized by spin-lattice (T_1) and spin-spin (T_2) relaxation times. Benedek's own contributions to the Knight shift demonstrate that the shift is an explicit function of temperature at constant volume. This is well explained by the effect of thermal lattice vibrations in modulating the coupling of the conduction electrons' spin with the nuclear spin. Other interesting observations include the *decrease* in the mean lattice vibration frequency with pressure in cuprous oxide from the pure quadrupole resonance spectrum of Cu^{63}; this is unusual behavior, since the Grüneisen constant is ordinarily a positive quantity ($\gamma = -\partial \ln \nu / \partial \ln V$). The discovery that the nuclear magnetic resonance frequency of Fe^{57} in metallic iron decreases linearly with pressure to at least 65 kilobars provides the basis for continuous pressure calibration into the region of "superpressures." One of the most sensitive of all physical measurements is the Mössbauer line shift; the pressure dependence of the shift of the 14.4 keV gamma ray of Fe^{57} in metallic iron amounts to only 7.8 parts in 10^{15} over the pressure range, 1 to 3000 atmospheres, and is due chiefly to the change in the mean lattice vibrational energy with pressure. These results give some idea of the extraordinary amount of detailed information on the electronic structure and lattice dynamics that can be obtained by combining high pressure techniques with resonance methods. Chapter 1 also details the elegant work of Barnes and his coworkers on the pressure dependence of self-diffusion in solid lithium and sodium metal, based upon the measurement of the spin-spin relaxation time of their nuclei. Hindered rotation effects in molecular solids and the kinetics of diffusion and ortho-para conversion in solid hydrogen have also been studied up to fairly high pressures.

Chapter 2 is concerned with nuclear magnetic resonance experiments in liquids and gases. The classical experiments by Dickinson on the paramagnetic shifts of cobalt complexes in aqueous solution, which are explained by the admixture of excited paramagnetic states into the ground state orbitals of the metal-ligand bond, have now been studied as a function of pressure. This opens up the possibility of obtaining the crystal field splitting as a function of the metal-ligand distance. Gaseous xenon exhibits a paramagnetic chemical shift which is proportional to the gas density, and is attributed to the decrease in the diamagnetic shielding by the collision-induced deformation of the electron distribution around the nucleus. As in solids, the pressure dependence of the spin-lattice relaxation time has led to valuable information on the activation volume for self-diffusion in liquids, and extensive studies have now been made on water, methyl iodide, and a variety of paraffinic hydrocarbons by the spin-echo method.

An all-too-brief appendix provides an overview of some of the experimental techniques which are useful in generating hydrostatic pressures and superpressures, together with bomb designs for magnetic resonance applications.

The book is very well written, by an author whose own contributions to the field are outstanding. Errors are few, and references to the outstanding papers are quite complete.

Elementary Chemical Thermodynamics. By Bruce H. Mahan. 155 pp. Benjamin, New York, 1963. Paper $1.95, Cloth $3.95. *Reviewed by* ***Joseph L. Katz****, University of Copenhagen.*

The study of thermodynamics has been usually postponed until a student's junior or senior year. This excellent introductory text by Professor Mahan will—permit those many instructors, who, until now, were deterred by the lack of a suitable elementary book, to include a brief session on thermodynamics in their general chemistry course.

The book is very carefully written. Despite very elementary language and mathematics a high level of rigor is maintained. The author begins by defining the basic concepts, "system", "state", "state function", "equilibrium states", and "temperature". He proceeds to a discussion of the first law, using many examples to illustrate that

the internal energy, but not heat nor work, is a state function. The second law is presented by postulating the existence of a state function, entropy, which is equal to the integral of dq (reversible) $/T$. Heavy stress is placed on the necessity of having a hypothetical reversible path to calculate the entropy. The Carnot Heat Engine is not mentioned until the last section where it is treated as an application of the second law. The book ends with short sections on electrochemical cells, phase equilibria ideal solution theory, and the Carnot engine. I can strongly recommend this book for use in a general chemistry course.

Intuition and Science. By Mario Bunge. 142 pp. Prentice-Hall, Englewood Cliffs, N.J., 1962. Paper $1.95.
Reviewed by ***Norman Feather****, University of Edinburgh.*

An innocent "Note to the Reader", inserted before the table of contents of this paperback, reads, "Most technical terms are explained in the glossary at the end of the book." The glossary occupies 10 pages of print; the main text only 120 pages. Even so, one reader who had fondly imagined that he could tackle anything of this length between paper covers in one session (if its subject was physical science in some general aspect) was quickly disillusioned. Dr. Bunge's monograph is compact of reference and argument; even with the glossary (which is not exhaustive) it is difficult reading.

This appraisal is not to discredit the author's intentions, nor his performance. His aim was to explore, for the first time comprehensively, as his publishers claim, the various varieties of human intuition which contribute to the advancement of formal mathematics and the interpretative hypotheses of factual science—and to examine the credentials of intuitionism as a valid stance for the philosopher.

Dr. Bunge writes vigorously on all these topics. He has read widely, he has formed his own opinions on matters of dispute, and he does not shrink from stating them pungently. He castigates philosophical intuitionism without mercy: "If we wish to have an adequate *theory* of intuition we should not resort to philosophers who abuse