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Note generali	"With 72 Figures."
Nota di bibliografia	Includes bibliographical references and index.
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-- 7.12 Operator Equivalents -- 7.13 Addition of Three Angular Momenta; Racah Coefficients -- 7.14 Electronic Wavefunctions for the Configuration $(nl)^x$ -- 7.15 Electrons and Holes -- 7.16 Evaluation of the Matrix Elements of Operators -- 8. Point Groups -- 8.1 Symmetry Operations in Point Groups -- 8.2 Point Groups and Their Notation -- 8.3 Class Structure in Point Groups -- 8.4 Irreducible Representations of Point Groups -- 8.5 Double-Valued Representations and Double Groups -- 8.6 Transformation of Spin and Orbital Functions -- 8.7 Constructive Derivation of Point Groups Consisting of Proper Rotations -- 9. Electronic States of Molecules -- 9.1 Molecular Orbitals -- 9.2 Diatomic Molecules: LCAO Method -- 9.3 Construction of LCAO-MO: The π -Electron Approximation for the Benzene Molecule -- 9.3.1 Further Methods for Determining the Basis Sets -- 9.4 The Benzene Molecule (Continued) -- 9.5 Hybridized Orbitals -- 9.5.1 Methane and sp^3 -Hybridization -- 9.6 Ligand Field Theory -- 9.7 Multiplet Terms in Molecules -- 9.8 Clebsch - Gordan Coefficients for Simply Reducible Groups and the Wigner-Eckart Theorem -- 10. Molecular Vibrations -- 10.1 Normal Modes and Normal Coordinates -- 10.2 Group Theory and Normal Modes -- 10.3 Selection Rules for Infrared Absorption and Raman Scattering -- 10.4 Interaction of Electrons with Atomic Displacements -- 10.4.1 Kramers Degeneracy -- 11. Space Groups -- 11.1 Translational Symmetry of Crystals -- 11.2 Symmetry Operations in Space Groups -- 11.3 Structure of Space Groups -- 11.4 Bravais Lattices -- 11.5 Nomenclature of Space Groups -- 11.6 The Reciprocal Lattice and the Brillouin Zone -- 11.7 Irreducible Representations of the Translation Group... -- 11.8 The Group of the Wavevector k and Its Irreducible Representations -- 11.9 Irreducible Representations of a Space Group -- 11.10 Double Space Groups -- 12. Electronic States in Crystals -- 12.1 Bloch Functions and $E(k)$ Spectra -- 12.2 Examples of Energy Bands: Ge and TlBr -- 12.3 Compatibility or Connectivity Relations -- 12.4 Bloch Functions Expressed in Terms of Plane Waves -- 12.5 Choice of the Origin -- 12.5.1 Effect of the Choice on Bloch Wavefunctions -- 12.6 Bloch Functions Expressed in Terms of Atomic Orbitals -- 12.7 Lattice Vibrations -- 12.8 The Spin-Orbit Interaction and Double Space Groups.... -- 12.9 Scattering of an Electron by Lattice Vibrations -- 12.10 Interband Optical Transitions -- 12.11 Frenkel Excitons in Molecular Crystals -- 12.12 Selection Rules in Space Groups -- 12.12.1 Symmetric and Antisymmetric Product Representations -- 13. Time Reversal and Nonunitary Groups -- 13.1 Time Reversal -- 13.2 Nonunitary Groups and Corepresentations -- 13.3 Criteria for Space Groups and Examples -- 13.4 Magnetic Space Groups -- 13.5 Excitons in Magnetic Compounds; Spin Waves -- 13.5.1 Symmetry of the Hamiltonian -- 14. Landau's Theory of Phase Transitions -- 14.1 Landau's Theory of Second-Order Phase Transitions -- 14.2 Crystal Structures and Spin Alignments -- 14.3 Derivation of the Lifshitz Criterion -- 14.3.1 Lifshitz's Derivation of the Lifshitz Criterion -- 15. The Symmetric Group -- 15.1 The Symmetric Group (Permutation Group) -- 15.2 Irreducible Characters -- 15.3 Construction of Irreducible Representation Matrices -- 15.4 The Basis for Irreducible Representations -- 15.5 The Unitary Group and the Symmetric Group -- 15.6 The Branching Rule -- 15.7 Wavefunctions for the Configuration $(nl)^x$ -- 15.8 $D(J)$ as Irreducible Representations of $SU(2)$ -- 15.9 Irreducible Representations of $U(m)$ -- Appendices -- A. The Thirty-Two Crystallographic Point Groups -- B. Character Tables for Point Groups -- Answers and Hints to the Exercises -- Motifs of the Family Crests -- References.

physics. The first Japanese edition was published in 1976. The present English edition has been translated by the authors from the revised and enlarged edition of 1980. In translation, slight modifications have been made in Chaps. 8 and 14 to update and condense the contents, together with some minor additions and improvements throughout the volume. The authors cordially thank Professor J. L. Birman and Professor M. Cardona, who encouraged them to prepare the English translation. Tokyo, January 1990 T. Inui . Y. Tanabe Y. Onodera

Preface to the Japanese Edition As the title shows, this book has been prepared as a textbook to introduce readers to the applications of group theory in several fields of physics. Group theory is, in a nutshell, the mathematics of symmetry. It has three main areas of application in modern physics. The first originates from early studies of crystal morphology and constitutes a framework for classical crystal physics. The analysis of the symmetry of tensors representing macroscopic physical properties (such as elastic constants) belongs to this category. The second area was enunciated by E. Wigner (1926) as a powerful means of handling quantum-mechanical problems and was first applied in this sense to the analysis of atomic spectra. Soon, H.
