

CONTENTS

PREFACE TO THE FIRST EDITION	V
PREFACE TO THE SECOND EDITION	VI
ACKNOWLEDGEMENTS	VII
CONTENTS	IX
CHAPTER I. INTRODUCTORY SURVEY OF PRACTICAL AND THEORETICAL SPECTROSCOPY	1
I. 1. Units and Spectral Regions	1
I. 2. Spectroscopic Equipment.	4
I. 3. The Spectrograph and the Spectrum	8
I. 4. Spectra and their Dependence on State of Aggregation, Pressure, and Temperature	9
I. 5. Main Result of Molecular Spectroscopy and its Interpretation	12
CHAPTER II. DERIVATION OF SOME IMPORTANT EQUATIONS IN SPECTROSCOPY	24
II. 1. Introduction	24
II. 2. Operators, Operands, Eigenfunctions, and Eigenvalues	25
II. 3. The Hamiltonian Operator and the Wave-functions	26
II. 4. The Particle in a Box	28
II. 5. The Two-body Problem	32
II. 6. The Hydrogen Atom	38
II. 7. The Diatomic Molecule.	48
II. 8. Selection Rules	51
II. 9. Intensity of Absorption Lines	57

CHAPTER III. MICROWAVE SPECTRA	60
III. 1. Research Possibilities	60
III. 2. Rotational Energy Levels for Different Molecular Types	61
III. 3. Selection Rules and Absorption Frequencies	68
III. 4. The Stark Effect	69
III. 5. Information on Molecular Constitution and Thermodynamic Properties from Microwave Spectra	74
CHAPTER IV. INFRARED SPECTRA	80
IV. 1. Research Possibilities	80
IV. 2. The Intramolecular Field of Force	81
IV. 3. Vibrational Energy Levels	86
IV. 4. Selection Rules and Absorption Frequencies	89
IV. 5. Rotational Fine-structure of Infrared Bands	93
IV. 6. Information on Molecular Constitution and Thermodynamic Properties from Infrared Spectra	94
CHAPTER V. SPECTRA OF THE VISIBLE-ULTRAVIOLET REGION	101
V. 1. Research Possibilities	101
V. 2. Distinction between Various Spectral Types	102
V. 3. Raman Spectra	105
V. 4. Electronic Band Spectra	109
V. 5. Electronic Energy Levels and Selection Rules	112
V. 6. Information on Molecular Constitution and Thermodynamic Properties from Electronic Band Spectra	119

CONTENTS

XI

CHAPTER VI. MAGNETIC RESONANCE	
SPECTRA	124
VI. 1. Research Possibilities	124
VI. 2. Energetics and Selection Rules	126
VI. 3. Interpretation of Nuclear Magnetic Resonance Spectra	127
VI. 4. Applications of Nuclear Magnetic Resonance Spectra	135
VI. 5. Interpretation of Electron Magnetic Resonance Spectra	138
VI. 6. Applications of Electron Magnetic Resonance Spectra	140
TABLE OF PHYSICAL CONSTANTS	141
INDEX	142