Contents

Preface vii

chapter 1	The Fundamental Concepts of Quantum Mechanics		
1-1	Probability in Quantum Mechanics	2	
1-2	The Uncertainty Principle 9		
1-3	Interfering Alternatives 13		
1-4	Summary of Probability Concepts	19	
1-5	Some Remaining Thoughts 22		
1-6	The Purpose of This Book 23		

Contents

	٠	٠
w	•	п

XII		
chapter	2	The Quantum-mechanical Law of Motion 25
	2-1	The Classical Action 26
	2-2	The Quantum-mechanical Amplitude 28
	2-3	The Classical Limit 29
	2-4	The Sum over Paths 31
	2-5	Events Occurring in Succession 36
	2-6	Some Remarks 38
chapter	3	Developing the Concepts with Special Examples 41
	3-1	The Free Particle 42
	3-2	Diffraction through a Slit 47
	3-3	Results for a Sharp-edged Slit 55
	3-4	The Wave Function 57
	3-5	Gaussian Integrals 58
	3-6	Motion in a Potential Field 62
	3-7	Systems with Many Variables 65
	3-8	Separable Systems 66
	3-9	The Path Integral as a Functional 68
	3-10	Interaction of a Particle and a Harmonic Oscillator 69
	3-11	Evaluation of Path Integrals by Fourier Series 71
chapter	4	The Schrödinger Description of Quantum Mechanics 75
	4-1	The Schrödinger Equation 76
	4-2	The Time-independent Hamiltonian 84
	4-3	Normalizing the Free-particle Wave Functions 89
chapter	5	Measurements and Operators 95
	5-1	The Momentum Representation 96
	5-2	Measurement of Quantum-mechanical Variables 106
	5-3	Operators 112
chapter	6	The Perturbation Method in Quantum Mechanics 119
	6-1	The Perturbation Expansion 120
	6-2	An Integral Equation for K_V 126
	6-3	An Expansion for the Wave Function 127
	6-4	The Scattering of an Electron by an Atom 129
	6-5	Time-dependent Perturbations and Transition Amplitudes 143

chapter 7	Transition Elements 163	
7-1	Definition of the Transition Element 164	
7-2	Functional Derivatives 170	
7- 3	•	174
7-4	•	
7-5	*	184
7-6		39
7-7	The Hamiltonian 192	
chapter 8	Harmonic Oscillators 197	
8-1	The Simple Harmonic Oscillator 198	
8-2	The Polyatomic Molecule 203	
8-3	Normal Coordinates 208	
8-4		
8-5	TI .	
8-6	Q	
8-7		
8-8	y	
8-9	The Forced Harmonic Oscillator 232	
chapter 9	Quantum Electrodynamics 235	
9-1	Classical Electrodynamics 237	
9-2	The Quantum Mechanics of the Radiation Field	242
9-3	The Ground State 244	
9-4	Interaction of Field and Matter 247	
9-5	A Single Electron in a Radiative Field 253	
9-6		
9-7	9	
9-8	Summary 262	
chapter 10	Statistical Mechanics 267	
10-1	The Partition Function 269	
10-2	The Path Integral Evaluation 273	
10-3	_	
10-4	Systems of Several Variables 287	
10-5	Remarks on Methods of Derivation 295	

1	$C_{\mathbf{n}}$	n	ŧ.	o	n	t e

chapter 11	The Variational Method 299		
11-1	A Minimum Principle 300		
11-2	An Application of the Variational Method 303		
11-3	The Standard Variational Principle 307		
11-4	Slow Electrons in a Polar Crystal 310		
chapter 12	Other Problems in Probability 321		
12-1	Random Pulses 322		
12-2	Characteristic Functions 324		
12-3	Noise 326		
12-4	Gaussian Noise 331		
12-5	Noise Spectrum 334		
12-6	Brownian Motion 336		
12-7	Quantum Mechanics 340		
12-8	Influence Functionals 343		
12-9	Influence Functional from a Harmonic Oscillator 351		
12-10	Conclusions 355		
Appendix	Some Useful Definite Integrals 357		

Index 359