## CONTENTS

	Preface	ix
I	Introductory Survey	1
	1. The Aim of Statistical Mechanics	1
	2. Approximate Methods in Statistical Mechanics	2
	3. Liquids. Solutions. Dilute Strong Electrolytes	4
	4. Plan of the Monograph	5
	Introduction to Equilibrium and	
	Nonequilibrium Statistical Mechanics	8
	1. Concept of an Ensemble and the Liouville Equation	8
	2. The Canonical Distribution	12
	3. Reduced Distribution Functions	15
	4. Average Values and Reduced Distribution Functions	19
	(a) Average Velocity	19
	(b) Average Potential Energy	20
	(c) Equilibrium Pressure	20
	5. The BBGKY Hierarchy Equations	23

CO	NT	ENT	S
----	----	-----	---

111	Equilibrium Properties of Dilute	
	Electrolyte Solutions	26
	1. The Problem of Long-Range Forces	26
	2. The Debye-Hückel Theory	28
	3. The Thermodynamic Properties of Dilute Electrolyte	
	Solutions	34 40
	4. The Statistical Approach	40
	5. Comments on Non-Limiting Law Effects	4/
IV	Brownian Motion	50
	1. Brownian Motion as a Model for Ions in Solution	50
	2. Random Walk	53
	3. The Classical Theory of Brownian Motion	58
	4. The Microscopic Theory of Brownian Motion	63
	5. The Connection Between Classical and Microscopic Brownian	74
	Motion Theory	77
	6. Applications of the Forker-Hanck Equation	
	(a) Electrical Conductivity (b) Diffusion	78
	(c) The Smoluchowski Equation	83
	7. Further Comments	87
v	Limiting-Law Transport Properties	88
	1. Evidence for Limiting-Law Effects in the Transport	
	Properties of Electrolytes	88
	2. The Microscopic Theory of the Relaxation Effect	92
	(a) The Starting Equations	92
	(b) The Hierarchy Equation	94
	(c) The Random Phase Approximation	97
	(d) The Solution Scheme	99
	(e) The Explicit Solution	103
	3. Electrophoresis and Other Limiting-Law Transport Properties	108
VI	Survey of Alternative Approaches	
	1. Introduction	113
	2. Mayer's Graph Theory	114
	(a) Cluster Integrals	114
	(b) Irreducible Cluster Integrals	120
	(c) Long-range Forces	123

CONTENTS		vii
3. The Tr	ansport Theory of Prigogine and Co-workers	128
(a) The	e Generalized Transport Equation	128
(b) The	e Transport Equation in an External Field	133
(c) The Limiting-Law Conductivity		134
4. The K	ubo Formula	136
Appendix A1	Some Properties of Fourier Transforms	139
Appendix A2	Complex Contour Integration	143
Appendix A3	The Statistical Mechanics of Dilute Solutions— Osmotic Pressure	146
Appendix A4	Eigenfunctions of the Fokker-Planck Operator	150
Appendix A5	A Parametric Form of the Equation of State of a	
	Real Gas	158
	Bibliography	161
	Index	163