

CONTENTS

<i>Preface</i>	v
Chapter 1 Introduction	1
1. Units and Dimensions	15
2. Cross Section and Differential Cross Section	18
3. Adiabatic Approximation	19
Problems	19
Bibliography	20
Chapter 2 Motion of Charged Particles in Fields	23
1. Introduction	23
2. The Equations of Motion for Ions in an Electrostatic Field	25
3. Concept of Average and Instantaneous Current Flow	28
4. Motion of Ion with Initial Velocity Perpendicular to the Electric Field	32
5. Motion of an Ion in a Homogeneous Magnetic Field	34
6. Motion of an Ion in a Perpendicular Electric and Magnetic Field	37
7. Parallel Electric and Magnetic Fields	42
8. Magnetic Lens (Cylindrical Symmetry)	50
9. Electrostatic Lens (Cylindrical Symmetry)	51
Problems	55
Chapter 3 Ion Sources	57
1. Electron Impact	59
2. Surface Ionization	63
3. Field Emission	69

4. Gas Discharge	72
5. Photon Impact	76
6. Monoenergetic Electron Sources	77
7. Ion Source Optics	82
8. Multiple Electron Beam Ion Sources	92
9. Mass Discrimination	97
10. Source Magnets	98
Problems	102

Chapter 4 Mass Analysis 104

1. Mass Analyzers	104
2. Sector Magnetic Fields	105
3. Shape of Perfect Focusing Magnetic Field	107
4. Resolution	110
5. Crossed Electric and Magnetic Field	115
6. Time of Flight	120
Problems	128

Chapter 5 Ion Detectors 130

1. Faraday Cage-Type Detector	130
2. The Electron Multiplier Detector	141
3. Magnetic Electron Multiplier	148
4. Photographic-Plate Detector	150
Problems	154

Chapter 6 Positive Ions 156

1. Positive Ionization	156
2. Concepts of Quantum Theory	157
3. Details of Ionization	160
4. Theoretical Approach to Ionization	162
5. Semiclassical Treatment of Ionization	166
6. Comparison of Theory and Experiment	169
7. Experimental Mass Spectra	169
8. Features of Mass Spectra	172
9. Quasiequilibrium Theory of Mass Spectra	176
Problems	188

Chapter 7 Negative Ions 190

1. Characteristics of Negative Ions	192
2. Mode of Formation	193
3. Experimental Methods	198

4. Pressure Dependence of Negative Ions	200
5. Calculation of Cross Section	203
6. Quantum Theory of Pair Production	205
7. Classical Theory of Pair Production	210
8. Electron Capture	211
9. Electron Affinity	222
10. Theory of Negative Ion Lifetimes	224
11. Negative Ion Mass Spectra	228
Problems	232

Chapter 8 Secondary Reactions 233

1. Classifications of Elementary Reactions	233
2. Maxwell-Boltzmann Distribution Law	238
3. Velocities of Molecules	241
4. Mean Free Path	242
5. Frequency of Collisions	244
6. Vacuum Techniques	245
7. Concepts in Vacuum Systems	246
8. Viscous and Molecular Flow	247
9. Rate of Evacuation of a System	248
10. Neutral Secondary Reactions	249
11. Ion-Molecule Reactions	251
12. Polarization of Molecules by Ions	252
13. Experimental Methods	265
Problems	271

Appendix 272

<i>Author Index</i>	299
<i>Subject Index</i>	305