



# CONTENTS

## Preface

ix

## I. PARTICLE MECHANICS

§1. The principle of the relativity of motion	1
§2. Velocity	3
§3. Momentum	5
§4. Motion under reactive forces	7
§5. Centre of mass	8
§6. Acceleration	10
§7. Force	12
§8. Dimensions of physical quantities	15
§9. Motion in a uniform field	19
§10. Work and potential energy	20
§11. The law of conservation of energy	23
§12. Internal energy	26
§13. Boundaries of the motion	27
§14. Elastic collisions	31
§15. Angular momentum	36
§16. Motion in a central field	40

## II. FIELDS

§17. Electrical interaction	44
§18. Electric field	46
§19. Electrostatic potential	49
§20. Gauss' theorem	51
§21. Electric fields in simple cases	53
§22. Gravitational field	56
§23. The principle of equivalence	60
§24. Keplerian motion	62

## III. MOTION OF A RIGID BODY

§25. Types of motion of a rigid body	66
§26. The energy of a rigid body in motion	68
§27. Rotational angular momentum	72
§28. The equation of motion of a rotating body	73
§29. Resultant force	77
§30. The gyroscope	78
§31. Inertia forces	81

## IV. OSCILLATIONS

§32. Simple harmonic oscillations	86
§33. The pendulum	90
§34. Damped oscillations	93

§35. Forced oscillations	96
§36. Parametric resonance	102

## V. THE STRUCTURE OF MATTER

§37. Atoms	105
§38. Isotopes	109
§39. Molecules	111

## VI. THE THEORY OF SYMMETRY

§40. Symmetry of molecules	115
§41. Stereoisomerism	118
§42. Crystal lattices	120
§43. Crystal systems	123
§44. Space groups	129
§45. Crystal classes	131
§46. Lattices of the chemical elements	133
§47. Lattices of compounds	137
§48. Crystal planes	139
§49. The natural boundary of a crystal	142

## VII. HEAT

§50. Temperature	144
§51. Pressure	149
§52. Aggregate states of matter	151
§53. Ideal gases	153
§54. An ideal gas in an external field	157
§55. The Maxwellian distribution	160
§56. Work and quantity of heat	166
§57. The specific heat of gases	171
§58. Solids and liquids	174

## VIII. THERMAL PROCESSES

§59. Adiabatic processes	178
§60. Joule-Kelvin processes	182
§61. Steady flow	184
§62. Irreversibility of thermal processes	187
§63. The Carnot cycle	190
§64. The nature of irreversibility	192
§65. Entropy	194

## IX. PHASE TRANSITIONS

§66. Phases of matter	197
§67. The Clausius-Clapeyron equation	201
§68. Evaporation	203
§69. The critical point	207
§70. Van der Waals' equation	210
§71. The law of corresponding states	214
§72. The triple point	216
§73. Crystal modifications	218
§74. Phase transitions of the second kind	222
§75. Ordering of crystals	225
§76. Liquid crystals	227

## X. SOLUTIONS

§77. Solubility	230
§78. Mixtures of liquids	232
§79. Solid solutions	234
§80. Osmotic pressure	236
§81. Raoult's law	238
§82. Boiling of a mixture of liquids	241
§83. Reverse condensation	244
§84. Solidification of a mixture of liquids	246
§85. The phase rule	250

## XI. CHEMICAL REACTIONS

§86. Heats of reaction	252
§87. Chemical equilibrium	254
§88. The law of mass action	256
§89. Strong electrolytes	262
§90. Weak electrolytes	264
§91. Activation energy	266
§92. Molecularity of reactions	270
§93. Chain reactions	272

## XII. SURFACE PHENOMENA

§94. Surface tension	276
§95. Adsorption	279
§96. Angle of contact	282
§97. Capillary forces	285
§98. Vapour pressure over a curved surface	288
§99. The nature of superheating and supercooling	289
§100. Colloidal solutions	291

## XIII. MECHANICAL PROPERTIES OF SOLIDS

§101. Extension	294
§102. Uniform compression	298
§103. Shear	301
§104. Plasticity	305
§105. Defects in crystals	308
§106. The nature of plasticity	312
§107. Friction of solids	316

## XIV. DIFFUSION AND THERMAL CONDUCTION

§108. The diffusion coefficient	318
§109. The thermal conductivity	319
§110. Thermal resistance	321
§111. The equalisation time	326
§112. The mean free path	328
§113. Diffusion and thermal conduction in gases	330
§114. Mobility	334
§115. Thermal diffusion	336
§116. Diffusion in solids	338

## XV. VISCOSITY

§117. The coefficient of viscosity	341
§118. Viscosity of gases and liquids	343

§119. Poiseuille's formula	345
§120. The similarity method	348
§121. Stokes' formula	350
§122. Turbulence	352
§123. Rarefied gases	357
§124. Superfluidity	361
Index	367

