

CONTENTS

PREFACE	page vii
CHAPTER I. <i>Historical introduction</i>	page 1
1·1. Drude's theory, p. 1. 1·2. Lorentz's theory, p. 3. 1·3. Boltzmann's equation, p. 4. 1·4. Solution of the Boltzmann equation assuming a time of relaxation, p. 6. 1·5. The existence of a time of relaxation when the ions behave as elastic spheres, p. 8. 1·6. Criticism of Lorentz's theory, p. 10. 1·7. The Fermi-Dirac statistics, p. 13. 1·8. Sommerfeld's model of a metal, p. 14. 1·9. Sommerfeld's theory of the conductivities, p. 17.	
CHAPTER II. <i>The motion of an electron in a perfect crystal lattice</i>	page 21
2·1. Ordinary differential equations with periodic coefficients, p. 21. 2·2. The motion of an electron in a three-dimensional lattice, p. 29. 2·3. The reciprocal lattice, p. 30. 2·4. X-ray reflexions in a crystal, p. 32. 2·5. The motion of nearly free electrons in a three-dimensional lattice, p. 34. 2·6. The motion of tightly bound electrons in a three-dimensional lattice, p. 38. 2·7. Energy bands of standard form, p. 42. 2·8. The current, p. 45. 2·9. The self-consistent field, p. 52.	
CHAPTER III. <i>Metallic structures</i>	page 56
3·1. Metals and insulators, p. 56. 3·2. Enumeration of the metallic structures, p. 57. 3·3. Accurate determination of the wave functions, p. 64. 3·4. The cohesion of metals, p. 70. 3·5. The energy zones of metals, p. 80. 3·6. Cubic structures, p. 81. 3·7. Hexagonal structures, p. 89. 3·8. Rhombohedral structures, p. 92. 3·9. The X-ray spectra of metals, p. 93.	
CHAPTER IV. <i>The structure of alloys</i>	page 101
4·1. Alloys of a non-metallic nature, p. 101. 4·2. Primary and secondary alloys, p. 102. 4·3. The copper-zinc alloys, p. 104. 4·4. The electron concentration in alloys, p. 108. 4·5. Superlattices, p. 110.	
CHAPTER V. <i>Semi-conductors</i>	page 112
5·1. General principles, p. 112. 5·2. The number of free electrons, p. 113. 5·3. Criteria for establishing the nature of the conductivity, p. 117. 5·4. Survey of some typical polar semi-conductors, p. 120. 5·5. Elemental semi-conductors, p. 125.	
CHAPTER VI. <i>The thermal and magnetic properties of metals</i>	page 133
6·1. The lattice specific heat, p. 133. 6·2. The electronic specific heat, p. 144. 6·3. Survey of the experimental data on specific heats, p. 148. 6·4. The spin paramagnetism, p. 150. 6·5. Survey of the experimental data on the magnetic susceptibility, p. 155. 6·6. The diamagnetism of free electrons, p. 160. 6·7. The de Haas-van Alphen effect, p. 169. 6·8. The diamagnetism of quasi-bound electrons, p. 175.	

CHAPTER VII. <i>Ferromagnetism</i>	page 178
7-1. Introduction, p. 178. 7-2. The formal classical theory, p. 179. 7-3. Collective electron ferromagnetism, p. 182. 7-4. The spontaneous magnetization, p. 184. 7-5. The specific heat, p. 186. 7-6. The susceptibility above the Curie point, p. 187. 7-7. The ferromagnetism of nickel, p. 188. 7-8. Other ferromagnetic metals, p. 191.	
CHAPTER VIII. <i>The formal theory of conduction</i>	page 193
8-1. The fundamental integral equation, p. 193. 8-2. The electrical conductivity, p. 196. 8-3. The thermal conductivity, p. 200. 8-4. The thermoelectric effects, p. 202. 8-5. The galvanomagnetic and thermomagnetic effects, p. 208. 8-6. Conduction in semi-conductors, p. 231. 8-7. Conduction in thin films, p. 242.	
CHAPTER IX. <i>The mechanism of conductivity</i>	page 251
9-1. Introduction, p. 251. 9-2. The lattice vibrations, p. 251. 9-3. The coupling between the electrons and the lattice, p. 254. 9-4. The residual resistance, p. 266. 9-5. The electrical conductivity at normal temperatures, p. 269. 9-6. The conductivity at low temperatures, p. 277. 9-7. The thermal conductivity, p. 286. 9-8. The lattice thermal conductivity, p. 292. 9-9. The steady state of the lattice, p. 296.	
CHAPTER X. <i>Application of the variation principle to conduction phenomena</i>	page 300
10-1. Introduction, p. 300. 10-2. The variation principle for isotropic metals, p. 302. 10-3. Solution of the variational problem, p. 304. 10-4. Matthiessen's rule, p. 310. 10-5. The magneto-resistance effects, p. 313. 10-6. Conduction in anisotropic media, p. 320.	
APPENDIX. <i>The Fermi-Dirac statistics</i>	page 326
A1. The distribution function, p. 326. A2. The thermodynamic functions, p. 328. A3. The statistics of a perfect electron gas, p. 330. A4. Integrals connected with the Fermi function, p. 331. A5. The evaluation of some associated integrals, p. 335.	
LIST OF IMPORTANT SYMBOLS, UNITS AND PHYSICAL CONSTANTS	page 338
INDEX OF SUBJECTS	page 341
INDEX OF NAMES	page 345