CONTENTS

PART ONE

MATTER, MOTION, AND FORCE

1. Gravity, A Field of Physics 3
2. Projectiles: Geometrical Addition: Vectors 36
3. Forces as Vectors 53
4. "It's Your Experiment": Laboratory Work 61
5. Law and Order among Stress and Strain 78
6. Surface Tension: Drops and Molecules 87
7. Force and Motion: $F = M \cdot a$ 105
8. Crashes and Collisions: Momentum 135
9. Fluid Flow 154
10. Vibrations and Waves 170

INTERLUDE

11. Appendix on Arithmetic 193

PART TWO

ASTRONOMY: A HISTORY OF THEORY

12. Mankind and the Heavens 207
13. Facts and Early Progress 213
14. Greek Astronomy: Great Theories and Great Observations 223
15. Awakening Questions 241
16. Nicolaus Copernicus (1473-1543) 244
17. Tycho Brahe (1546-1601) 251
18. Johannes Kepler (1571-1630) 261
19. Galileo Galilei (1564-1642) 273
20. The Seventeenth Century 287
21. Circular Orbits and Acceleration 295
22. Isaac Newton (1642-1727) 312
23. Universal Gravitation 336
24. Scientific Theories and Scientific Methods 341

PART THREE

MOLECULES AND ENERGY

25. The Great Molecular Theory of Gases 353
26. Energy 370
27. Measuring Heat and Temperature 412
28. Power. A Chapter for Laboratory Work 425
29. The Principle of Conservation of Energy—Experimental Basis 432
30. Kinetic Theory of Gases: Fruitful Expansion 444

INTERLUDE

31. Mathematics and Relativity 468

PART FOUR

ELECTRICITY AND MAGNETISM

32. Electric Circuits in Laboratory 503
33. Electric Charges and Fields 533
34. Magnetism: Facts and Theory 568
35. Chemistry and Electrolysis 586

PART FIVE

ATOMIC AND NUCLEAR PHYSICS

36. Electrons and Electron Fields 607
37. Magnetic Catapults: Driving Motors and Investigating Atoms 615
38. Analyzing Atoms 624
39. Radioactivity and the Tools of Nuclear Physics 633
40. Atoms: Experiment and Theory 648
41. Laboratory Work with Electrons: from Generators to Oscilloscopes 655
42. Atom Accelerators—The Big Machines 672
43. Nuclear Physics 682
44. More Theory and Experiment: Physics Today 714

General Problems 760

Index 771