
Contents

<i>Preface</i>	ix
	A Whimsical Prelude 1
<i>Chapter 1</i>	The Founding Fathers: Galileo and Huygens 15 <i>Pisa: preparation. Padua: marvels of the skies. Florence: glory and downfall. Huygens: a transition figure.</i>
<i>Chapter 2</i>	The Magic Mountain: Newton 45 <i>A complex, mysterious personality. Revelations to the Cambridge student. Lucasian professor: light decomposed. The Principia and the fabric of the universe. Past the prime of his age for invention. Science abandoned: warden of the mint and the darker side.</i>
<i>Chapter 3</i>	What Is Light? 79 <i>Newton's heirs: mathematics and nature. The mathematicians. The physicists. Light is waves: Thomas Young, a universal talent. The French scientific nurseries. Fresnel's perfection. The messages of the spectra: Fraunhofer, Bunsen, and Kirchhoff.</i>
<i>Chapter 4</i>	Electricity: From Thunder to Motors and Waves 105 <i>The difficult conquest of electrostatics and magnetism. Help from the frogs: Galvani and Volta and "the most marvelous</i>

instrument invented by mankind.” Electromagnetism: the current and the needle—Oersted and Ampère. A fresh look and a powerful imagination: Faraday—from bookbinder to prince of science and experimenter supreme. Infallible in physics: Maxwell. A bridge to modern physics: H. A. Lorentz.

Chapter 5 Heat: Substance, Vibration, and Motion 186

Between chemistry and physics: the properties of gases. Patriotism, engineering, and genius: Carnot and his prophet William Thomson. The solid fortress, thermodynamics: conservation of energy—Mayer, Joule, and Helmholtz. Thermodynamics perfected: Rudolf Clausius.

Chapter 6 Kinetic Theory: The Beginning of the Unraveling of the Structure of Matter 233

Unfortunate precursors. Again, Clausius and Maxwell. Ludwig Boltzmann. Statistics and probability enter physics. Real gases, as found in nature. Van der Waals's marvelous equation. The Yankee physicist Gibbs.

Conclusions 252

Appendixes

1. Newton's mathematical principles (Section II): the determination of centripetal forces. 255
2. Newton's mathematical principles (Section III): the motion of bodies in eccentric conic sections. 257
3. Kepler's laws in modern standard derivation. 259
4. Kirchhoff's law on heat exchange. 261
5. The arguments of the "Newton of electricity." 262
6. The measurement of the ratio of electrostatic to electromagnetic units of charge and the velocity of light. 264
7. Plane waves from Maxwell's equations. 267
8. The influence of pressure on the melting point of ice. 270

9. The absolute scale of temperature and the gas thermometer. 273
10. Maxwell's distribution of velocities of molecules in his own words. 275
11. Boltzmann's epitaph. 277
12. The essentials of Boltzmann's H-theorem. 278
13. Dilemmas posed by the equipartition of energy. 280
14. The marvelous equation of van der Waals and Clausius' virial theorem. 281

Bibliography 284

Name Index 289

Subject Index 294