

CONTENTS

	PAGE
PREFACE	v
INTRODUCTION	1
Subject Matter of Physics—Matter—Conservation of Matter— Energy—System of Units—Units of Length—Units of Mass— Units of Time—Units of Volume—Density	

PART I.—MECHANICS

CHAPTER I

MOTIONS OF TRANSLATION	6
Uniform Motion—Types of Motion—Speed—Constant and Variable Speeds—Speed as a Scalar Quantity—Velocity—Velocity as a Vector Quantity—Addition of Velocities—Acceleration—Illus- trations of Uniform Acceleration—Motions of Bodies with Con- stant Velocity—Motions of Bodies with Constant Acceleration Starting from Rest—Motion of Bodies with Constant Acceleration and Initial Velocity—Path of a Projectile Horizontally—Pro- jectile Fired at Angle to Horizontal	

CHAPTER II

FORCES AND MOTIONS	21
Force—Newton's First Law of Motion—Inertia—Momentum— Newton's Second Law of Motion—Absolute Units of Force— Gravitational Units of Force—Mass and Weight—Relation between Absolute and Gravitational Units—Newton's Third Law of Motion—Universal Gravitation—The Mass of the Earth— Variation of Gravity—Formation of Tides	

CHAPTER III

COMPOSITION AND RESOLUTION OF FORCES	32
Representation of Forces—Resultant—Resultant of Forces Acting at Right Angles—Resultant of Forces Not at Right Angles— Illustrations of Composition of Forces—Derrick Crane—Resultant of More Than Two Forces—Resolution of Forces—Rectangular Components of a Force	

CHAPTER IV

EQUILIBRIUM OF FORCES	41
Torque—Conditions of Equilibrium—Center of Gravity—Method of Finding the Center of Gravity—Simple Cases of Center of	

	PAGE
Gravity—Types of Equilibrium—Stability of a Body—Illustrations of Conditions for Equilibrium	
CHAPTER V	
WORK, POWER, ENERGY	48
Work—Gravitational Units of Work—Erg—Power—Horsepower and Watt—Definition of Energy—Potential and Kinetic Energy—Conservation of Energy—Measure of Potential Energy—Measure of Kinetic Energy—Transformations of Potential and Kinetic Energy—Illustrations	
CHAPTER VI	
FRICTION	58
Nature of Friction—Kinds of Friction—Laws of Friction—Coefficient of Friction—Rolling Friction—Advantages of Friction—Efficiency of Machines—Action of Lubricants—Friction on an Inclined Plane—Power Transmitted by a Belt	
CHAPTER VII	
SIMPLE MACHINES	64
Levers—Law of Lever—Mechanical Advantage—Levers of the First Class—Levers of the Second Class—Levers of the Third Class—The Balance—Double Weighing—Wheel and Axle—Pulleys—Combination of Pulleys—The Differential Pulley—The Inclined Plane—Grade—The Wedge—The Screw—The Jackscrew—Combinations of Simple Machines	
CHAPTER VIII	
MOLECULAR FORCES AND MOTIONS	78
Molecular Theory of Matter—States of Matter—Diffusion of Gases—Absorption of Gases—Diffusion of Liquids—Solutions—Osmosis—Illustrations of Osmosis—Crystalloids and Colloids—Osmotic Pressure—Laws of Osmotic Pressure—Cohesion and Adhesion—Cohesion in Soils—Surface Energy and Surface Tension—Capillarity—Cause of Variation in Height of Rise—Illustrations of Capillarity—Capillary Action in Soils	
CHAPTER IX	
LIQUIDS AT REST	93
Characteristics of Liquids—Pressure of Liquids under Action of Gravity—Pressure in Vessels of Different Shape—Liquids in Communicating Vessels—Pressure Transmitted by a Liquid—Pascal's Principle—Multiplication of Force by Transmission of Pressure—Hydraulic Bellows—Hydraulic Elevator—Liquids in Communicating Tubes—A Hydraulic Press	

CHAPTER X

ARCHIMEDES' PRINCIPLE. 103

Buoyancy of Liquids—Archimedes' Principle—Explanation of Archimedes' Principle—Archimedes' Principle Applied to Fish—Float Valve—Floating Ship or Boat—Stability of Floating Bodies—Density and Specific Gravity—Density of Solids Heavier than Water—Density of Solids, Lighter than Water—Specific-gravity Bottle—Hydrometer—Lactometer

CHAPTER XI

MECHANICAL PROPERTIES OF GASES. 112

Composition of the Air—Weight of Air—Buoyant Effect of the Air—Correction for the Buoyancy of the Air—Pressure of the Air—Torricelli's Experiment—Mercury Barometer—The Aneroid Barometer—Depth of the Atmosphere—Applications of Atmospheric Pressure—The Siphon—The Intermittent Spring—Compressibility of Gases—Applications of Boyle's Law—The Air-pressure Tank—Compressed-air Lifts

CHAPTER XII

FLUIDS IN MOTION 127

Flow of Fluids or Gases—Viscosity—Effect of Viscosity on Motion of Objects—Lift Pump—Force Pump—Measuring Pump—Circulation of the Blood—Water Motors—A Hydraulic Ram—Force Exerted by a Jet—Pressure in a Moving Fluid—Torricelli's Theorem—Illustrations of Changing Pressure in Fluids

CHAPTER XIII

ELASTICITY AND STRENGTH OF MATERIALS. 140

Stress—Strain—Elasticity—Modulus of Elasticity—Hooke's Law—Young's Modulus of Elasticity—Volume Elasticity—Limit of Elasticity—Elasticity in Tissues and Bones—Stiffness and Strength of Beams—Cross Section of Beams

CHAPTER XIV

ROTARY MOTIONS. 149

Circular Measure of Angles—Angular Velocity—Angular Velocities in Pulleys and Wheels—Angular Acceleration—Equations of Angular Motion—Relation of Torque to Angular Acceleration—Rotary Inertia—Kinetic Energy of Rotation—Combination of Energy of Translation and Rotation

CHAPTER XV

THE CONSERVATION OF MOMENTUM. 161

Linear Momentum—Angular Momentum—Impulse—Conservation of Momentum—Experimental Illustration of Conservation

of Momentum—Inelastic and Elastic Bodies—Impact of Inelastic Bodies—Impact of Elastic Bodies

CHAPTER XVI

PERIODIC MOTIONS 168

Vibrations—Types of Vibration—Uniform Circular Motion—Acceleration in Uniform Circular Motion—Centripetal Force—Cream Separator and Centrifuge—Steam-engine Governor—Centrifugal Force on the Moon—Rotation of Two Spheres about Their Common Center of Mass—Effect of Centrifugal Force on the Weight of a Body—Precessional Motion—Simple Harmonic Motion—Simple Pendulum

PART II.—WAVE MOTION AND SOUND

CHAPTER XVII

WAVE MOTION. 183

Wave Motion—Transverse Waves—Compressional and Longitudinal Waves—Water Waves—Other Kinds of Waves—Wave Front—Intensity of Spherical Waves—Velocity of Waves—Amplitude and Frequency—Relation between Wave Length, Frequency, and Velocity—Representation of Waves—Standing Waves—Tuning Forks

CHAPTER XVIII

PRODUCTION AND TRANSMISSION OF SOUND. 194

Nature of Sound—Velocity of Sound—Speed of Sound in Warm and Cold Air—Effect of Wind on Wave Front—Pitch and Frequency—Loudness—Quality—Photography of Sound Waves—Intensity of Sound—Sound Ranging—Detection of Aircraft by Sound—Location of Sound under Water

CHAPTER XIX

REFLECTION, REFRACTION, ABSORPTION AND INTERFERENCE 204

Reflection of Sound—Angle of Reflection—Refraction of Sound Waves—Sound Waves in a Room—Absorption of Sound—Insulation of Sounds in Buildings—Passage of Sound from One Medium to Another—Reverberation—Interference of Sound Waves—Beats—Doppler Effect

CHAPTER XX

SOUNDING BODIES. 218

Vibrations of Wires and Strings—Vibration of Closed Pipes—Vibrations of Open Pipes

CONTENTS

xi
PAGE

CHAPTER XXI

AUDITION AND VOICE SOUNDS. 223

Speech Sounds—Distribution of Energy in Speech Sounds—
Production of Speech Sounds—Heart and Lung Sounds—The
Phonodeik—Phonograph

PART III.—HEAT

CHAPTER XXII

TEMPERATURE AND ITS MEASUREMENT 230

Temperature—Mercury Thermometer—Comparison of Centigrade
and Fahrenheit Thermometers—Maximum and Minimum Ther-
mometers—Clinical Thermometers

CHAPTER XXIII

MEASUREMENT OF HEAT. 235

Unit of Heat—Calorie—The British Thermal Unit—Specific
Heat—Water Equivalent—Measurement of Heat by Method of
Mixtures—Influence of Temperature on the Specific Heat of
Solids—Heat Value of Fuels—Continuous-flow Calorimeter—
Measurement of the Energy Value of Foods

CHAPTER XXIV

EXPANSION BY HEAT 244

Expansion of Solids—Unequal Expansion of Solids—Measurement
of Expansion—Illustrations of Expansion—Unequal Expansion of
Substances—Expansion of Liquids—Maximum Density of Water—
Expansion of Gases—Rise of Smoke in a Chimney—Expansion of
Gases in Cooking—Hot-air Heating System—Ventilation—
Charles's Law—Heating a Gas at Constant Volume—Absolute
Scale of Temperature—The General Gas Law—Application to
Different Masses of Gases

CHAPTER XXV

KINETIC THEORY OF GASES 259

Brownian Motions—Basic Assumptions—Molecular Velocities in
Gases—Monomolecular Films—The Mean Free Path and the
Number of Collisions per Second—Molecular Magnitudes—
Pressure of a Gas from the Kinetic Theory—Specific Heats of
Gases—Relation of Temperature to the Kinetic Energy of the
Molecules—Elasticity of Gases—Molecular Attractions in Gases—
Deviations from Boyle's Law

CHAPTER XXVI

FUSION 272

The Melting Point—Heat of Fusion—Supercooling—Change of
Volume during Fusion—Forces Exerted by Freezing Water—

Effect of Pressure on Melting Point—The Refrigerator—Freezing Points of Solutions—Freezing Mixtures

CHAPTER XXVII

VAPORIZATION 279

Evaporation—Saturated Vapor—Vapor-pressure Curve—Heat of Vaporization—Cooling by Evaporation—Evaporation from Soils—Evaporation from Leaves—Boiling Point of Water—Effect of Pressure on Boiling Point—Pressure Cooker—Vacuum Pans—Boiling Point of Solutions—Distillation—Household Stills—Sublimation—Triple Point—The Critical Point—Transition through the Critical Point—Liquefaction of Gases

CHAPTER XXVIII

ATMOSPHERIC HUMIDITY 295

Water Vapor in the Air—Clouds, Fogs, Dew, Etc.—Dew Point—Relative Humidity—Measurement of Humidity—Chemical Hygrometer—Importance of Atmospheric Humidity

CHAPTER XXIX

TRANSFER OF HEAT 300

Convection—Draft in a Stove—Trade Winds—The Hot-water Tank—The Hot-water Furnace—Ventilating System—Radiator of a Gasoline Engine—Conduction—Measurement of Thermal Conductivity

CHAPTER XXX

RADIATION 309

Transfer of Heat by Radiation—Exchange of Radiations—Character of Radiating Surface—Absorption of Radiation—Absorption of Radiation by Soils of Different Colors—Absorption of Radiation by the Air—Reflection of Radiations—Dewar Flask or Thermos Bottle—Solar Constant—Measuring the Solar Constant—Influence of Slope on Temperature of Soils—Sources of Solar Radiation

CHAPTER XXXI

HEAT AND WORK 371

Nature of Heat—Mechanical Equivalent of Heat—First Law of Thermodynamics—Second Law of Thermodynamics—Steam Engine—Gas Engine—The Two-stroke Cycle Engine—Work Done by a Gas Expanding at Constant Pressure—Work Done by a Gas Expanding at Variable Pressure—Positive and Negative Work—Efficiency—Isothermal Changes—Adiabatic Changes—Carnot Cycle—Efficiency of a Carnot Engine—Indicator Card—Indicator—Indicated Horsepower of an Engine—Brake Horsepower—Refrigerating Machines

PART IV.—MAGNETISM AND ELECTRICITY

CHAPTER XXXII

MAGNETISM 388

Natural Magnets—Artificial Magnets—Magnetic Poles—Law of Force between Magnetic Poles—Unit Pole—Magnetic Field—Magnetic Lines of Force—The Earth's Magnetic Field—Declination—Magnetic Dip—The Variation of the Earth's Magnetic Field—Classes of Magnetic Substances—Molecular Theory of Magnetism—Electron Theory of Magnetism—Magnetic Induction

CHAPTER XXXIII

ELECTROSTATICS 348

Two Kinds of Electricity—Law of Electric Force—Electrical Field of Force—The Electron—Positive and Negative Charges—Conductors and Insulators—Electrostatic Induction—The Electroscope—Lightning—Surface Density—Difference of Potential—Electrostatic Unit of Difference of Potential—Concentric Spheres—Potential at a Point—Energy to Charge a Conductor—Atmospheric Electricity—Piezoelectricity—The Electric Current

CHAPTER XXXIV

ELECTROMAGNETIC FIELDS. 365

Magnetic Effect of an Electric Current—Definition of Unit Current—Ampere—Unit of Quantity—Magnetic Field around a Coil—Moving-coil Galvanometer—Ammeter—Voltmeter

CHAPTER XXXV

ELECTRICAL RESISTANCE AND OHM'S LAW 374

Electrical Pressure—Volt and Abvolt—Electric Currents and Water Currents—Resistance—Ohm's Law—Units of Resistance—Resistance Boxes—Laws of Resistance—Resistivity—Temperature Coefficient of Resistance—Temperature Coefficient of Alloys—Electron Theory of Electrical Conductivity—Superconductivity of Metals—Relation of Electrical to Thermal Conductivity—Resistance Thermometers—Resistance for High-frequency Currents—Measurement of Resistance by Ammeter and Voltmeter—Wheatstone Bridge—Postoffice Box Bridge

CHAPTER XXXVI

SIMPLE ELECTRIC CIRCUITS. 392

Kirchhoff's Laws—Resistance in Series—Resistance in Parallel—Shunts—Cells Connected in Series—Cells Connected in Parallel—Ohm's Law in Part of Circuit and Brush Potential

CHAPTER XXXVII

HEAT AND ELECTRIC CURRENTS.	403
Heating by Electricity—Joule's Law—To Compute the Power— Electrical Energy in Heat Units—Electric Fuses—Electric Light Dimmers—Continuous-flow Method for Measuring Specific Heat of Liquids—Thermal Couples—Thermopiles—Peltier Effect— Thomson Effect	

CHAPTER XXVIII

CHEMICAL EFFECTS OF AN ELECTRIC CURRENT	415
Electrolysis of Copper Sulphate—Electrolysis of Water—Copper Plating—Nickel Plating—Faraday's Laws of Electrolysis—Elec- trochemical Equivalent—Effect of Electrolysis on Water Mains— Charge on an Ion—Computing Avogadro's Number—Electrolytic Conduction in Solids—Primary Batteries—Leclanche Cell—The Dry Cell—Lead Storage Cell—Edison Storage Cell—Weston Standard Cell—Potentiometer	

CHAPTER XXXIX

THE MAGNETIC CIRCUIT AND ITS APPLICATIONS.	430
Flux and Flux Density—Permeability—Magnetomotive Force— Reluctance—The Law of the Magnetic Circuit—Magnetization of Iron—Hysteresis—Influence of Temperature on Magnetic Phen- omena—Electromagnet—Magnetic Brake—Magnetic Separator —Electric Horn	

CHAPTER XL

INDUCED CURRENTS.	441
Currents Induced by Moving Magnets—Currents Induced by Currents—Making and Breaking the Circuit—Law of Induced Electromotive Forces—Lenz's Law—Direction of Induced Electro- motive Force—Electromotive Force Induced in Moving Wire— Electromotive Force from Change of Flux—Quantity of Electricity from Induced Electromotive Forces—The Induction Coil—Make- and-break Ignition—High-tension Ignition—The Transformer— The Autotransformer—Telephone	

CHAPTER XLI

THE DYNAMO	457
The Current in a Revolving Loop—Sine Curve of Electromotive Force—Collecting Rings—The Commutator—Ring and Drum Armature—Excitation of the Fields of Generators—Series-wound Dynamo—Shunt-wound Dynamo—Compound-wound Dynamo —Losses in a Generator—Magneto—Efficiency of Generators	

CONTENTS

CHAPTER XLII

MOTORS. 468

The Dynamo Reversed—Force on a Wire in a Magnetic Field—
Hand Rule for Motor—Types of Motors and Back Electromotive
Force in a Motor—Starting Box—Efficiency of a Motor—Record-
ing Wattmeter

CHAPTER XLIII

MUTUAL INDUCTANCE AND SELF-INDUCTANCE. 474

Mutual Inductance—Coefficient of Mutual Induction—Self-induc-
tance—Coefficient of Self-induction—Energy Stored Up about a
Current

CHAPTER XLIV

CAPACITANCE OF CONDENSERS 481

The Condenser—Relation between Charge and Voltage—Capaci-
tance or Capacity—Unit Capacitance—Dielectric Constant—
Capacity of an Isolated Sphere—Capacity of a Spherical Con-
denser—Capacity of Two Parallel Plates—Second Definition of
Capacitance—Hydraulic Analogy—Condensers in Parallel—Con-
densers in Series—Energy Stored in a Condenser—Charging and
Discharging a Condenser through a Resistance—Oscillatory
Discharge

CHAPTER XLV

ALTERNATING CURRENTS. 494

Alternating Currents—Water Analogy—Instantaneous Electro-
motive Force—Average Value of Alternating Electromotive Force
—Effective Value of Alternating Current—Relation of Current to
Voltage in Circuits—Resonance in Series Circuits—Power in Alter-
nating-current Circuits

PART V.—ELECTRONICS

CHAPTER XLVI

FREE ELECTRONS. 504

Conductivity of Gases in the Normal State—Ionization of Gases—
Ionization by Flames—Velocity of Electrons—Variation of Current
with Potential—Ionization by Impact—Discharge in Gases at Low
Pressures—Cathode Rays—Determination of the Ratio of the
Charge to the Mass—Condensation of Water Vapor on Ions—
The Charge on an Electron—Mass of an Electron—The Mass of an
Electron as a Function of Its Velocity—Passage of Electrons
through Matter—Computing the Weight of Atoms—Positive Rays
—Atmospheric Electricity

CHAPTER XLVII

DISCHARGE OF ELECTRONS FROM HOT WIRES AND APPLICATIONS	525
Discharge from Hot Wires—Thoriated-tungsten Filament—Distribution of Electrons at the Surface of a Hot Wire—The Thermionic Valve—Tungar Rectifier—The Audion	

CHAPTER XLVIII

ELECTROMAGNETIC WAVES.	531
Electrical Oscillations—Sending and Receiving Electric Waves—Radio Telephony—Reflection of Electric Waves by Kennelly-Heaviside Layer	

PART VI.—PHYSICAL AND GEOMETRICAL OPTICS

CHAPTER XLIX

NATURE AND PROPAGATION OF LIGHT	539
Nature of Light—Velocity of Light—Michelson's Latest Method—Frequency and Wave Length—Sources of Light—Rectilinear Propagation of Light—Total, Annular, and Partial Eclipses	

CHAPTER L

ILLUMINATION AND PHOTOMETRY	546
Standards of Illumination—Candle Power—The Foot-candle—The Lumen—Law of Inverse Squares—Photometer—Bunsen Grease-spot Photometer—Lummer-Brodhun Photometer	

CHAPTER LI

REFLECTION OF LIGHT.	553
Laws of Reflection—Image in a Plane Mirror—Reflection of Light at an Opaque Surface—Selective Reflection—Concave Spherical Mirrors—Principal Focus—Construction of Images in a Concave Mirror—Construction of Images in a Convex Mirror—Formula for Spherical Mirror—Size of Object and Image—Parabolic Mirror	

CHAPTER LII

REFRACTION OF LIGHT.	564
Refraction—Laws of Refraction—Refraction through a Slab with Parallel Faces—Apparent Thickness of a Transparent Body—Atmospheric Refraction—Refraction through a Prism—Determination of Index of Refraction of a Prism—Critical Angle—Total Reflection—Lighthouse Reflector—Prismatic Window Glass	

CHAPTER LIII

LENSES	575
Lenses—Spherical Aberration of a Lens—Diopter—Optical Center—Graphical Construction of Images—Magnification of Image	

by a Lens—Formulae for Lenses—The Lens Formula—Combination of Two Thin Lenses—Telephoto Lenses

CHAPTER LIV

OPTICAL INSTRUMENTS. 586

Photographic Camera—Relative Aperture of a Lens—Projection Lantern—Simple Microscope—Compound Microscope—Astronomical Telescope—Opera or Field Glasses—Prism Binoculars—Sextant—Ultra-microscope—Optical Pyrometer—Periscope—Anatomy of the Eye—The Eye—Defects of Vision—Astigmatism—Convergence and Divergence—Visual Judgments—Binocular Vision—Sensibility of the Human Eye—Absorption of Ultra-violet Radiations by the Eye—Electrical Response of the Retina

CHAPTER LV

SPECTRA AND COLOR 606

Separation of Light by a Prism—The Spectrometer—Achromatic Prism—Dispersion without Deviation—Achromatic Lenses—Continuous Spectra—Ultra-violet and Infra-red Spectra—Bright-line Spectra—Doppler Effect for Spectral Lines—Spectrum Analysis—Origin of Light Waves—Color of Bodies—Compounding Colors—Mixing Pigments—Absorption of Light by Liquids, Solids, and Gases—Absorption Spectrum of Blood—Fraunhofer Lines—Absorption Spectrum of Chlorophyll—The Young-Helmholtz Theory of Color Vision—Color Blindness—Effect of Ultra-violet Light on Living Matter—Luminescence

CHAPTER LVI

INTERFERENCE AND DIFFRACTION. 625

Interference of Water Waves—Interference of Light Waves—Michelson Interferometer—Interference in Thin Films—Diffraction—Huygens' Principle—Diffraction by a Straight Edge—Diffraction of Light by a Narrow Wire—Diffraction through a Narrow Slit—Diffraction by a Circular Aperture—Diffraction Grating

CHAPTER LVII

POLARIZATION AND SACCHARIMETRY. 640

Polarization—Polaroids—Polarization by Reflection—Plane of Polarization—Double Refraction—Nicol Prism—Rotation of the Plane of Polarization—Specific Rotation—Polarimeter—Magnetic Rotation of the Plane of Polarization

PART VII.—RADIATION AND ATOMIC STRUCTURE

CHAPTER LVIII

ORIGIN OF QUANTUM THEORY 651

Definition of a Black Body—Stefan's Law—Wien's Displacement Law—Relation of Intensity of Radiation to Frequency—Photo-

electric Effect—Relation between Velocities of Photoelectrons and the Frequency of the Light—Calculation of Planck's Constant from the Photoelectric Effect—Photoelectric Cells—Barrier-layer Photoelectric Cell—Transmission of Pictures over Telephone Wires—Series Relations in Spectra

CHAPTER LIX

RADIOACTIVE SUBSTANCES 662

Radioactive Substances—Nature of the Radiations—Nature of the Alpha Particles—Counting Alpha Particles—Absorption of Alpha Particles by Matter—Scattering of Alpha Particles—Nature and Properties of Beta Rays—Nature and Properties of Gamma Rays—Disintegration of Uranium—Nature and Properties of Radium—Age of the Earth—Heating Effect of Radium—Chemical Action of Radium

CHAPTER LX

STRUCTURE OF THE ATOM 674

Thomson's Atomic Model—Rutherford-Bohr Atomic Model—The Hydrogen Atom—Helium—Lithium—Beryllium—Atoms of Higher Atomic Weights—Periodic Table—Arrangement of Electrons in Shells

CHAPTER LXI

NUCLEAR PHYSICS 682

Bombardment of Atoms with Alpha Particles—Acceleration of Charged Particles—Cloud-chamber Method of Observing Collisions—The Positron—The Neutron—Deuterium and the Deuteron—Transmutation by Capture of Protons, Deuterons, or Neutrons—Artificial Radioactivity—Protons and Neutrons in the Nucleus—Explanation of Isotopes—Packing Effect—Cosmic Rays—Intensity of Cosmic Rays as Function of Latitude

CHAPTER LXII

SERIES IN OPTICAL SPECTRA 698

Units and the Methods of Measurement—Balmer's Formula for Hydrogen—Rydberg's Formula—Bohr's Theory of the Hydrogen Atom—Rydberg Constant—Excitation of Atoms and Energy Levels—Direct Measurement of Energy Levels—Work of Removing Electron from Atom—Extension of Bohr's Theory to Other Atoms—The Spectra of Ionized Atoms—Spinning Electron—The Zeeman Effect—The Stark Effect—Molecular Spectra

CHAPTER LXIII

X-RAYS AND CRYSTAL STRUCTURE 714

Production of X-rays—Measurement of the Intensity of X-rays—Medical Applications of X-rays—Industrial Applications of

CONTENTS

xix

PAGE

X-rays—Diffraction of X-rays—X-ray Spectrometer—Crystal Structure—Two Types of X-ray Spectra—Characteristic X-ray Spectra—Absorption of X-rays—X-ray Energy Levels—Work to Displace an Electron from One Shell to Another Shell—The Compton Effect—Wave Length of an Electron

CHAPTER LXIV

ASTROPHYSICS	732
Solar Prominences—The Solar Corona—Sun Spots—Types of Stellar Spectra—Globular Star Clusters—Nebulae—Novae—Spectra of Comets—Interior of Stars—Sources of Stellar Energy	
APPENDICES	747
TABLES	766
INDEX	777