## Index

Symbols

(peak) emf 23.5 Electric Generators

Α

aberrations 26.6 Aberrations

absolute pressure 11.6 Gauge Pressure, Absolute Pressure, and Pressure Measurement

absolute zero 13.1 Temperature

AC current 20.5 Alternating Current versus Direct Current

AC voltage 20.5 Alternating Current versus Direct Current

acceleration 2.4 Acceleration, 4.3 Newton's Second Law of Motion: Concept of a System

acceleration due to gravity 2.7 Falling Objects

accommodation 26.1 Physics of the Eye

Accuracy 1.3 Accuracy, Precision, and Significant Figures

acoustic impedance 17.7 Ultrasound

active transport 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes

activity 31.5 Half-Life and Activity

adaptive optics 26.5 Telescopes

adhesive forces 11.8 Cohesion and Adhesion in Liquids: Surface Tension and Capillary Action

adiabatic 15.2 The First Law of Thermodynamics and Some Simple Processes

air resistance 3.4 Projectile Motion

alpha 31.1 Nuclear Radioactivity

alpha decay 31.4 Nuclear Decay and Conservation Laws

Alternating current 20.5 Alternating Current versus Direct Current

ammeters 21.4 DC Voltmeters and Ammeters

ampere 20.1 Current

Ampere's law 22.9 Magnetic Fields Produced by Currents: Ampere's Law

amplitude 16.3 Simple Harmonic Motion: A Special Periodic Motion, 24.2 Production of Electromagnetic Waves, 24.4 Energy in Electromagnetic Waves

amplitude modulation 24.3 The Electromagnetic Spectrum

Analog meters 21.4 DC Voltmeters and Ammeters

Analytical methods 3.3 Vector Addition and Subtraction: Analytical Methods

Anger camera 32.1 Diagnostics and Medical Imaging

angular acceleration 10.1 Angular Acceleration

angular magnification 26.5 Telescopes

angular momentum 10.5 Angular Momentum and Its Conservation

angular momentum quantum number 30.8 Quantum Numbers and Rules

angular velocity 6.1 Rotation Angle and Angular Velocity

antielectron 31.4 Nuclear Decay and Conservation Laws

antimatter 31.4 Nuclear Decay and Conservation Laws

antinode 16.10 Superposition and Interference, 17.5 Sound Interference and Resonance: Standing Waves in Air Columns

approximations 1.4 Approximation

arc length 6.1 Rotation Angle and Angular Velocity

Archimedes' principle 11.7 Archimedes' Principle

astigmatism 26.2 Vision Correction

atom 30.1 Discovery of the Atom

atomic de-excitation 30.5 Applications of Atomic Excitations and De-Excitations

atomic excitation 30.5 Applications of Atomic Excitations and De-Excitations

atomic mass 31.3 Substructure of the Nucleus

atomic number 30.9 The Pauli Exclusion Principle, 31.3 Substructure of the Nucleus

atomic spectra 29.1 Quantization of Energy

average acceleration 2 Section Summary

Average Acceleration 2.4 Acceleration

Average speed 2.3 Time, Velocity, and Speed

Average velocity 2.3 Time, Velocity, and Speed

Avogadro's number 13.3 The Ideal Gas Law

axions 34.4 Dark Matter and Closure

axis of a polarizing filter 27.8 Polarization

B-field 22.3 Magnetic Fields and Magnetic Field Lines

back emf 23.6 Back Emf

banked curves 6.3 Centripetal Force

barrier penetration 31.7 Tunneling

baryon number 33.4 Particles, Patterns, and Conservation Laws

Baryons 33.4 Particles, Patterns, and Conservation Laws

basal metabolic rate 7.8 Work, Energy, and Power in Humans

beat frequency 16.10 Superposition and Interference

becquerel 31.5 Half-Life and Activity

Bernoulli's equation 12.2 Bernoulli's Equation

Bernoulli's principle 12.2 Bernoulli's Equation

beta 31.1 Nuclear Radioactivity

beta decay 31.4 Nuclear Decay and Conservation Laws

Big Bang 34.1 Cosmology and Particle Physics

binding energy 29.2 The Photoelectric Effect, 31.6 Binding Energy

binding energy per nucleon 31.6 Binding Energy

bioelectricity 20.7 Nerve Conduction–Electrocardiograms

Biot-Savart law 22.9 Magnetic Fields Produced by Currents: Ampere's Law

birefringent 27.8 Polarization

Black holes 34.2 General Relativity and Quantum Gravity

blackbodies 29.1 Quantization of Energy

blackbody radiation 29.1 Quantization of Energy

Bohr radius 30.3 Bohr's Theory of the Hydrogen Atom

Boltzmann constant 13.3 The Ideal Gas Law

boson 33.4 Particles, Patterns, and Conservation Laws

bottom 33.5 Quarks: Is That All There Is?

bow wake 17.4 Doppler Effect and Sonic Booms

break-even 32.5 Fusion

breeder reactors 32.6 Fission

breeding 32.6 Fission

bremsstrahlung 29.3 Photon Energies and the Electromagnetic Spectrum

Brewster's angle 27.8 Polarization

Brewster's law 27.8 Polarization

bridge devices 21.5 Null Measurements

Brownian motion 30.1 Discovery of the Atom

buoyant force 11.7 Archimedes' Principle

 $\mathbf{C}$ 

capacitance 19.5 Capacitors and Dielectrics, 21.6 DC Circuits Containing Resistors and Capacitors

capacitive reactance 23.11 Reactance, Inductive and Capacitive

capacitor 19.5 Capacitors and Dielectrics, 21.6 DC Circuits Containing Resistors and Capacitors

capillary action 11.8 Cohesion and Adhesion in Liquids: Surface Tension and Capillary Action

carbon-14 dating 31.5 Half-Life and Activity

Carnot cycle 15.4 Carnot's Perfect Heat Engine: The Second Law of Thermodynamics Restated

Carnot efficiency 15.4 Carnot's Perfect Heat Engine: The Second Law of Thermodynamics Restated

Carnot engine 15.4 Carnot's Perfect Heat Engine: The Second Law of Thermodynamics Restated

carrier particles 4.8 Extended Topic: The Four Basic Forces—An Introduction carrier wave 24.3 The Electromagnetic Spectrum

cathode-ray tubes 30.2 Discovery of the Parts of the Atom: Electrons and Nuclei

Celsius 13.1 Temperature

center of gravity 9.2 The Second Condition for Equilibrium

center of mass 6.5 Newton's Universal Law of Gravitation

centrifugal force 6.4 Fictitious Forces and Non-inertial Frames: The Coriolis Force

centrifuge 6.2 Centripetal Acceleration

centripetal acceleration 6.2 Centripetal Acceleration

centripetal force 6.3 Centripetal Force

change in angular velocity 10.1 Angular Acceleration

change in entropy 15.6 Entropy and the Second Law of Thermodynamics: Disorder and the Unavailability of Energy

change in momentum 8.2 Impulse

Chaos 34.5 Complexity and Chaos

characteristic time constant 23.10 RL Circuits

characteristic x rays 29.3 Photon Energies and the Electromagnetic Spectrum

charm 33.5 Quarks: Is That All There Is?

chart of the nuclides 31.3 Substructure of the Nucleus

chemical energy 7.6 Conservation of Energy

classical physics 1.1 Physics: An Introduction

Classical relativity 3.5 Addition of Velocities

coefficient of linear expansion 13.2 Thermal Expansion of Solids and Liquids

coefficient of performance 15.5 Applications of Thermodynamics: Heat Pumps and Refrigerators

coefficient of volume expansion 13.2 Thermal Expansion of Solids and Liquids

coherent 27.3 Young's Double Slit Experiment

cohesive forces 11.8 Cohesion and Adhesion in Liquids: Surface Tension and Capillary Action

Colliding beams 33.3 Accelerators Create Matter from Energy

color 33.5 Quarks: Is That All There Is?

color constancy 26.3 Color and Color Vision

commutative 3.2 Vector Addition and Subtraction: Graphical Methods, 3 Section Summary

complexity 34.5 Complexity and Chaos

components 3.2 Vector Addition and Subtraction: Graphical Methods

compound microscope 26.4 Microscopes

Compton effect 29.4 Photon Momentum

Conduction 14.4 Heat Transfer Methods

conductor 18.2 Conductors and Insulators

Conductors 18.7 Conductors and Electric Fields in Static Equilibrium

confocal microscopes 27.9 \*Extended Topic\* Microscopy Enhanced by the Wave Characteristics of Light

conservation laws 21.3 Kirchhoff's Rules

Conservation of energy Introduction to Work, Energy, and Energy Resources conservation of mechanical energy 7.4 Conservative Forces and Potential Energy conservation of momentum principle 8.3 Conservation of Momentum

Conservation of total 33.4 Particles, Patterns, and Conservation Laws conservation of total baryon number 33.4 Particles, Patterns, and Conservation Laws

conservation of total L L 33.4 Particles, Patterns, and Conservation Laws conservative force 7.4 Conservative Forces and Potential Energy constructive interference 16.10 Superposition and Interference constructive interference for a diffraction grating 27.4 Multiple Slit Diffraction constructive interference for a double slit 27.3 Young's Double Slit Experiment contact angle 11.8 Cohesion and Adhesion in Liquids: Surface Tension and Capillary Action

Contrast 27.9 \*Extended Topic\* Microscopy Enhanced by the Wave Characteristics of Light

Convection 14.4 Heat Transfer Methods

converging (or convex) lens  $25.6~\mathrm{Image}$  Formation by Lenses

conversion factor 1.2 Physical Quantities and Units

Coriolis force 6.4 Fictitious Forces and Non-inertial Frames: The Coriolis Force

corner reflector 25.4 Total Internal Reflection

correspondence principle Introduction to Quantum Physics

cosmic microwave background 34.1 Cosmology and Particle Physics

cosmological constant 34.4 Dark Matter and Closure

cosmological red shift 34.1 Cosmology and Particle Physics

Cosmology 34.1 Cosmology and Particle Physics

Coulomb force 18.4 Electric Field: Concept of a Field Revisited

Coulomb forces 18.3 Coulomb's Law

Coulomb interaction 18.6 Electric Forces in Biology

Coulomb's law 18.3 Coulomb's Law

critical angle 25.4 Total Internal Reflection

Critical damping 16.7 Damped Harmonic Motion

critical density 34.4 Dark Matter and Closure

critical mass 32.6 Fission

critical point 13.5 Phase Changes

Critical pressure 13.5 Phase Changes

critical temperature 13.5 Phase Changes, 34.6 High-temperature Superconductors

criticality 32.6 Fission

curie 31.5 Half-Life and Activity

Curie temperature 22.2 Ferromagnets and Electromagnets

current 21.1 Resistors in Series and Parallel

Current sensitivity 21.4 DC Voltmeters and Ammeters

cyclical process 15.3 Introduction to the Second Law of Thermodynamics: Heat Engines and Their Efficiency

cyclotron 33.3 Accelerators Create Matter from Energy

D

Dalton's law of partial pressures 13.5 Phase Changes

dark matter 34.4 Dark Matter and Closure

daughters 31.4 Nuclear Decay and Conservation Laws

de Broglie wavelength 29.6 The Wave Nature of Matter

decay 31.1 Nuclear Radioactivity, 31.4 Nuclear Decay and Conservation Laws

decay constant 31.5 Half-Life and Activity

decay equation 31.4 Nuclear Decay and Conservation Laws, 31.4 Nuclear Decay and Conservation Laws, 31.4 Nuclear Decay and Conservation Laws

decay series 31.4 Nuclear Decay and Conservation Laws

deceleration 2.4 Acceleration

defibrillator 19.7 Energy Stored in Capacitors

deformation 5.3 Elasticity: Stress and Strain, 16.1 Hooke's Law: Stress and Strain Revisited

degree Celsius 13.1 Temperature

degree Fahrenheit 13.1 Temperature

Density 11.2 Density

dependent variable 2.8 Graphical Analysis of One-Dimensional Motion

derived units 1.2 Physical Quantities and Units

destructive interference 16.10 Superposition and Interference

destructive interference for a double slit 27.3 Young's Double Slit Experiment

destructive interference for a single slit 27.5 Single Slit Diffraction

dew point 13.6 Humidity, Evaporation, and Boiling

dialysis 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes

diastolic pressure 11.6 Gauge Pressure, Absolute Pressure, and Pressure Measurement, 11.9 Pressures in the Body

dielectric 19.5 Capacitors and Dielectrics

dielectric strengths 19.5 Capacitors and Dielectrics

diffraction 27.2 Huygens's Principle: Diffraction

diffraction grating 27.4 Multiple Slit Diffraction

Diffusion 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes

digital meters 21.4 DC Voltmeters and Ammeters

dipole 18.6 Electric Forces in Biology

Direct current 20.5 Alternating Current versus Direct Current

direction 3.2 Vector Addition and Subtraction: Graphical Methods

direction of magnetic field lines 22.3 Magnetic Fields and Magnetic Field Lines

direction of polarization 27.8 Polarization

Dispersion 25.5 Dispersion: The Rainbow and Prisms

displacement 2.1 Displacement

Distance 2.1 Displacement

Distance traveled 2.1 Displacement

diverging lens 25.6 Image Formation by Lenses

domains 22.2 Ferromagnets and Electromagnets

Doppler effect 17.4 Doppler Effect and Sonic Booms

Doppler shift 17.4 Doppler Effect and Sonic Booms

Doppler-shifted ultrasound 17.7 Ultrasound

Double-slit interference 30.3 Bohr's Theory of the Hydrogen Atom

down 33.5 Quarks: Is That All There Is?

drag force 5.2 Drag Forces

drift velocity 20.1 Current

dynamic equilibrium 9.1 The First Condition for Equilibrium

Dynamics Introduction to Dynamics: Newton's Laws of Motion, 4.1 Development of Force Concept, 4 Section Summary

 $\mathbf{E}$ 

eddy current 23.4 Eddy Currents and Magnetic Damping

efficiency 7.6 Conservation of Energy

Elapsed time 2.3 Time, Velocity, and Speed

elastic collision 8.4 Elastic Collisions in One Dimension, 8.4 Elastic Collisions in One Dimension

elastic potential energy 16.1 Hooke's Law: Stress and Strain Revisited

electric and magnetic fields 24.4 Energy in Electromagnetic Waves

electric charge 18.1 Static Electricity and Charge: Conservation of Charge

electric current 20.1 Current

electric field 18.7 Conductors and Electric Fields in Static Equilibrium, 24.2 Production of Electromagnetic Waves

Electric field lines 24.1 Maxwell's Equations: Electromagnetic Waves Predicted and Observed

electric field strength 18.4 Electric Field: Concept of a Field Revisited

electric fields 18.5 Electric Field Lines: Multiple Charges

Electric generators 23.5 Electric Generators

electric potential 19.1 Electric Potential Energy: Potential Difference

electric power 20.4 Electric Power and Energy

Electrical energy 7.6 Conservation of Energy

electrocardiogram (ECG) 20.7 Nerve Conduction-Electrocardiograms

electromagnetic force Introduction to Electric Charge and Electric Field

electromagnetic induction 23.1 Induced Emf and Magnetic Flux

electromagnetic waves Introduction to Electromagnetic Waves, 24.2 Production of Electromagnetic Waves, 24.4 Energy in Electromagnetic Waves

Electromagnetism 22.2 Ferromagnets and Electromagnets

electromagnets 22.2 Ferromagnets and Electromagnets

electromotive force 21.2 Electromotive Force: Terminal Voltage

Electron capture 31.4 Nuclear Decay and Conservation Laws

electron capture equation 31.4 Nuclear Decay and Conservation Laws

electron family number 33.4 Particles, Patterns, and Conservation Laws

electron volt 19.1 Electric Potential Energy: Potential Difference

electron's antineutrino 31.4 Nuclear Decay and Conservation Laws

electron's neutrino 31.4 Nuclear Decay and Conservation Laws

electrons 18.1 Static Electricity and Charge: Conservation of Charge

electrostatic equilibrium 18.7 Conductors and Electric Fields in Static Equilibrium

electrostatic force 18.3 Coulomb's Law

electrostatic precipitators 18.8 Applications of Electrostatics

Electrostatic repulsion 18.2 Conductors and Insulators

electrostatics 18.8 Applications of Electrostatics

electroweak epoch 34.1 Cosmology and Particle Physics

electroweak theory 33.6 GUTs: The Unification of Forces

emf 21.3 Kirchhoff's Rules

emf induced in a generator coil 23.5 Electric Generators

emissivity 14.7 Radiation

endoscope 25.4 Total Internal Reflection

energies of hydrogen-like atoms 30.3 Bohr's Theory of the Hydrogen Atom

energy Introduction to Work, Energy, and Energy Resources

energy stored in an inductor 23.9 Inductance

energy-level diagram 30.3 Bohr's Theory of the Hydrogen Atom

English units 1.2 Physical Quantities and Units

entropy 15.6 Entropy and the Second Law of Thermodynamics: Disorder and the Unavailability of Energy

equipotential lines 19.4 Equipotential Lines

escape velocity 34.2 General Relativity and Quantum Gravity

event horizon 34.2 General Relativity and Quantum Gravity

external force 4.3 Newton's Second Law of Motion: Concept of a System

external forces 4.1 Development of Force Concept, 4 Section Summary

Extremely low frequency (ELF) 24.3 The Electromagnetic Spectrum

eyepiece 26.4 Microscopes

F

Fahrenheit 13.1 Temperature

far point 26.2 Vision Correction

Faraday cage 18.7 Conductors and Electric Fields in Static Equilibrium

Faraday's law of induction 23.2 Faraday's Law of Induction: Lenz's Law

Farsightedness 26.2 Vision Correction

fermion 33.4 Particles, Patterns, and Conservation Laws

ferromagnetic 22.2 Ferromagnets and Electromagnets

Feynman diagram 33.2 The Four Basic Forces

Fiber optics 25.4 Total Internal Reflection

fictitious force 6.4 Fictitious Forces and Non-inertial Frames: The Coriolis Force

fine structure 30.7 Patterns in Spectra Reveal More Quantization

first law of thermodynamics 15.1 The First Law of Thermodynamics

first postulate of special relativity 28.1 Einstein's Postulates

fission fragments 32.6 Fission

flat (zero curvature) universe 34.4 Dark Matter and Closure

flavors 33.5 Quarks: Is That All There Is?

Flow rate 12.1 Flow Rate and Its Relation to Velocity

fluid dynamics Introduction to Fluid Dynamics and Its Biological and Medical Applications

fluids 11.1 What Is a Fluid?

Fluorescence 30.5 Applications of Atomic Excitations and De-Excitations

focal length 25.6 Image Formation by Lenses

focal point 25.6 Image Formation by Lenses

Food irradiation 32.4 Food Irradiation

force 4.1 Development of Force Concept, 4 Section Summary

force constant 16.1 Hooke's Law: Stress and Strain Revisited

force field 4.8 Extended Topic: The Four Basic Forces—An Introduction, 4.8 Extended Topic: The Four Basic Forces—An Introduction, 18.4 Electric Field: Concept of a Field Revisited

fossil fuels 7.9 World Energy Use

free charges 18.7 Conductors and Electric Fields in Static Equilibrium

free electrons 18.2 Conductors and Insulators

free radicals 32.4 Food Irradiation

free-body diagram 4.1 Development of Force Concept, 4.6 Problem-Solving Strategies, 4 Section Summary

free-fall 2.7 Falling Objects, 4.3 Newton's Second Law of Motion: Concept of a System

Frequency 16.2 Period and Frequency in Oscillations, 24.2 Production of Electromagnetic Waves

frequency modulation 24.3 The Electromagnetic Spectrum

friction 4.3 Newton's Second Law of Motion: Concept of a System, 5.1 Friction, 7.5 Nonconservative Forces

full-scale deflection 21.4 DC Voltmeters and Ammeters

fundamental 17.5 Sound Interference and Resonance: Standing Waves in Air Columns

fundamental frequency 16.10 Superposition and Interference

fundamental particle 33.5 Quarks: Is That All There Is?

fundamental units 1.2 Physical Quantities and Units

G

galvanometer 21.4 DC Voltmeters and Ammeters

gamma 31.1 Nuclear Radioactivity

gamma camera 32.1 Diagnostics and Medical Imaging

Gamma decay 31.4 Nuclear Decay and Conservation Laws

gamma ray 24.3 The Electromagnetic Spectrum

Gamma rays 29.3 Photon Energies and the Electromagnetic Spectrum

gauge bosons 33.4 Particles, Patterns, and Conservation Laws

gauge pressure  $11.6~\mathrm{Gauge}$  Pressure, Absolute Pressure, and Pressure Measurement

gauss 22.4 Magnetic Field Strength: Force on a Moving Charge in a Magnetic Field

Geiger tube 31.2 Radiation Detection and Detectors

general relativity 34.2 General Relativity and Quantum Gravity

geometric optics 25.1 The Ray Aspect of Light

glaucoma 11.9 Pressures in the Body

gluons 33.2 The Four Basic Forces, 33.6 GUTs: The Unification of Forces

Grand Unified Theory (GUT) 33.6 GUTs: The Unification of Forces

gravitational constant 6.5 Newton's Universal Law of Gravitation

gravitational potential energy 7.3 Gravitational Potential Energy

Gravitational waves 34.2 General Relativity and Quantum Gravity

gray (Gy) 32.2 Biological Effects of Ionizing Radiation

greenhouse effect 14.7 Radiation

grounded 18.8 Applications of Electrostatics

grounding 19.4 Equipotential Lines

GUT epoch 34.1 Cosmology and Particle Physics

Η

Hadrons 33.4 Particles, Patterns, and Conservation Laws

half-life 31.5 Half-Life and Activity

Hall effect 22.6 The Hall Effect

Hall emf 22.6 The Hall Effect

harmonics 17.5 Sound Interference and Resonance: Standing Waves in Air Columns

head 3.2 Vector Addition and Subtraction: Graphical Methods

head-to-tail method 3.2 Vector Addition and Subtraction: Graphical Methods, 3 Section Summary

Hearing 17.1 Sound, 17.6 Hearing

heat 14.1 Heat

heat engine 15.2 The First Law of Thermodynamics and Some Simple Processes

heat of sublimation 14.3 Phase Change and Latent Heat

heat pump's coefficient of performance 15.5 Applications of Thermodynamics: Heat Pumps and Refrigerators

heat transfer Introduction to Temperature, Kinetic Theory, and the Gas Laws

Heisenberg uncertainty principle 29.7 Probability: The Heisenberg Uncertainty Principle

Heisenberg's uncertainty principle 29.7 Probability: The Heisenberg Uncertainty Principle

henry 23.9 Inductance

Higgs boson 33.6 GUTs: The Unification of Forces

high dose 32.2 Biological Effects of Ionizing Radiation

hologram 30.5 Applications of Atomic Excitations and De-Excitations

Holography 30.5 Applications of Atomic Excitations and De-Excitations

Hooke's law 5.3 Elasticity: Stress and Strain

horizontally polarized 27.8 Polarization

Hormesis 32.2 Biological Effects of Ionizing Radiation

horsepower 7.7 Power

Hubble constant 34.1 Cosmology and Particle Physics

hues 26.3 Color and Color Vision

Human metabolism 15.1 The First Law of Thermodynamics

Huygens's principle 27.2 Huygens's Principle: Diffraction

Hydrogen spectrum wavelength 30.3 Bohr's Theory of the Hydrogen Atom

hydrogen-like atom 30.3 Bohr's Theory of the Hydrogen Atom

hydrogen-spectrum wavelengths 30.3 Bohr's Theory of the Hydrogen Atom

hyperopia 26.2 Vision Correction

Ι

ideal banking 6.3 Centripetal Force

ideal gas law 13.3 The Ideal Gas Law

Ignition 32.5 Fusion

Image distance 25.6 Image Formation by Lenses

impedance 23.12 RLC Series AC Circuits

impulse 8.2 Impulse

Incoherent 27.3 Young's Double Slit Experiment

independent variable 2.8 Graphical Analysis of One-Dimensional Motion

index of refraction 25.3 The Law of Refraction

inductance 23.9 Inductance

induction 18.2 Conductors and Insulators, Introduction to Electromagnetic Induction, AC Circuits and Electrical Technologies

inductive reactance 23.11 Reactance, Inductive and Capacitive

inductor 23.9 Inductance

inelastic collision 8.5 Inelastic Collisions in One Dimension

inertia 4.2 Newton's First Law of Motion: Inertia, 4 Section Summary

inertial confinement 32.5 Fusion

inertial frame of reference 4.5 Normal, Tension, and Other Examples of Forces, 28.1 Einstein's Postulates

inflationary scenario 34.1 Cosmology and Particle Physics

Infrared radiation 24.3 The Electromagnetic Spectrum

Infrared radiation (IR) 29.3 Photon Energies and the Electromagnetic Spectrum

infrasound 17.6 Hearing

ink jet printer 18.8 Applications of Electrostatics

Instantaneous acceleration 2.4 Acceleration

Instantaneous speed 2.3 Time, Velocity, and Speed

Instantaneous velocity 2.3 Time, Velocity, and Speed

insulators 18.2 Conductors and Insulators

intensity 16.11 Energy in Waves: Intensity, 17.3 Sound Intensity and Sound Level, 24.4 Energy in Electromagnetic Waves

intensity reflection coefficient 17.7 Ultrasound

Interference microscopes 27.9 \*Extended Topic\* Microscopy Enhanced by the Wave Characteristics of Light

internal energy 15.1 The First Law of Thermodynamics

Internal kinetic energy 8.4 Elastic Collisions in One Dimension, 8.4 Elastic Collisions in One Dimension

internal resistance 21.2 Electromotive Force: Terminal Voltage

intraocular pressure 11.9 Pressures in the Body

intrinsic magnetic field 30.7 Patterns in Spectra Reveal More Quantization

intrinsic spin 30.7 Patterns in Spectra Reveal More Quantization

ionizing radiation 29.3 Photon Energies and the Electromagnetic Spectrum, 31.1 Nuclear Radioactivity

ionosphere 18.7 Conductors and Electric Fields in Static Equilibrium

irreversible process 15.3 Introduction to the Second Law of Thermodynamics: Heat Engines and Their Efficiency

isobaric process 15.2 The First Law of Thermodynamics and Some Simple Processes

isochoric 15.2 The First Law of Thermodynamics and Some Simple Processes isolated system 8.3 Conservation of Momentum

isothermal 15.2 The First Law of Thermodynamics and Some Simple Processes isotopes 31.3 Substructure of the Nucleus

J

joule 7.1 Work: The Scientific Definition

Joule's law 21.1 Resistors in Series and Parallel

junction rule 21.3 Kirchhoff's Rules

K

Kelvin 13.1 Temperature

kilocalorie 14.1 Heat

kilogram 1.2 Physical Quantities and Units

kilowatt-hours 7.7 Power

kinematics Introduction to One-Dimensional Kinematics, 3.4 Projectile Motion

kinematics of rotational motion 10.2 Kinematics of Rotational Motion

kinetic energy 7.2 Kinetic Energy and the Work-Energy Theorem

kinetic friction 5.1 Friction

Kirchhoff's rules 21.3 Kirchhoff's Rules

 $\mathbf{L}$ 

Laminar 12.4 Viscosity and Laminar Flow; Poiseuille's Law

laser 30.5 Applications of Atomic Excitations and De-Excitations

Laser printers 18.8 Applications of Electrostatics

Laser vision correction 26.2 Vision Correction

latent heat coefficients 14.3 Phase Change and Latent Heat

law 1.1 Physics: An Introduction

law of conservation of angular momentum 10.5 Angular Momentum and Its Conservation

law of conservation of charge 18.1 Static Electricity and Charge: Conservation of Charge

law of conservation of energy 7.6 Conservation of Energy

law of inertia 4.2 Newton's First Law of Motion: Inertia, 4 Section Summary

law of refraction 25.3 The Law of Refraction

Length contraction 28.3 Length Contraction

Lenz's law 23.2 Faraday's Law of Induction: Lenz's Law

leptons 33.4 Particles, Patterns, and Conservation Laws

linear accelerator 33.3 Accelerators Create Matter from Energy

linear hypothesis 32.2 Biological Effects of Ionizing Radiation

Linear momentum 8.1 Linear Momentum and Force

liquid drop model 32.6 Fission

liter 12.1 Flow Rate and Its Relation to Velocity

longitudinal wave 16.9 Waves

loop rule 21.3 Kirchhoff's Rules

Lorentz force 22.4 Magnetic Field Strength: Force on a Moving Charge in a Magnetic Field

loudness 17.6 Hearing

low dose 32.2 Biological Effects of Ionizing Radiation

M

MACHOs 34.4 Dark Matter and Closure

macrostate 15.7 Statistical Interpretation of Entropy and the Second Law of Thermodynamics: The Underlying Explanation

magic numbers 31.3 Substructure of the Nucleus

magnetic confinement 32.5 Fusion

magnetic damping 23.4 Eddy Currents and Magnetic Damping

magnetic field 22.3 Magnetic Fields and Magnetic Field Lines, 24.2 Production of Electromagnetic Waves

magnetic field lines 22.3 Magnetic Fields and Magnetic Field Lines, 24.1 Maxwell's Equations: Electromagnetic Waves Predicted and Observed

magnetic field strength (magnitude) produced by a long straight current-carrying wire 22.9 Magnetic Fields Produced by Currents: Ampere's Law

magnetic field strength at the center of a circular loop 22.9 Magnetic Fields Produced by Currents: Ampere's Law

magnetic field strength inside a solenoid 22.9 Magnetic Fields Produced by Currents: Ampere's Law

magnetic flux 23.1 Induced Emf and Magnetic Flux

magnetic force 22.4 Magnetic Field Strength: Force on a Moving Charge in a Magnetic Field

magnetic monopoles 22.2 Ferromagnets and Electromagnets

Magnetic resonance imaging (MRI) 22.11 More Applications of Magnetism

magnetized 22.2 Ferromagnets and Electromagnets

magnetocardiogram (MCG) 22.11 More Applications of Magnetism

magnetoencephalogram (MEG) 22.11 More Applications of Magnetism

magnification 25.6 Image Formation by Lenses

magnitude 3.2 Vector Addition and Subtraction: Graphical Methods

magnitude of kinetic friction f k f k 5.1 Friction

magnitude of static friction f s f s 5.1 Friction

magnitude of the intrinsic (internal) spin angular momentum 30.8 Quantum Numbers and Rules

mass 4.2 Newton's First Law of Motion: Inertia, 4 Section Summary

mass number 31.3 Substructure of the Nucleus

massive compact halo objects 34.4 Dark Matter and Closure

maximum field strength 24.4 Energy in Electromagnetic Waves

Maxwell's equations 22.9 Magnetic Fields Produced by Currents: Ampere's Law, 24.1 Maxwell's Equations: Electromagnetic Waves Predicted and Observed

mechanical advantage 9.5 Simple Machines

mechanical energy 7.4 Conservative Forces and Potential Energy, 19.1 Electric Potential Energy: Potential Difference

mechanical equivalent of heat 14.1 Heat

meson 33.1 The Yukawa Particle and the Heisenberg Uncertainty Principle Revisited

Mesons 33.4 Particles, Patterns, and Conservation Laws

metabolic rate 7.8 Work, Energy, and Power in Humans

metastable 30.5 Applications of Atomic Excitations and De-Excitations

meter 1.2 Physical Quantities and Units

Meters 22.8 Torque on a Current Loop: Motors and Meters

method of adding percents 1.3 Accuracy, Precision, and Significant Figures

metric system 1.2 Physical Quantities and Units

Michelson-Morley experiment 28.1 Einstein's Postulates

Microgravity 6.5 Newton's Universal Law of Gravitation

microlensing 34.4 Dark Matter and Closure

microshock sensitive 20.6 Electric Hazards and the Human Body

microstate 15.7 Statistical Interpretation of Entropy and the Second Law of Thermodynamics: The Underlying Explanation

Microwaves 24.3 The Electromagnetic Spectrum, 29.3 Photon Energies and the Electromagnetic Spectrum

micturition reflex 11.9 Pressures in the Body

model 1.1 Physics: An Introduction, 2.3 Time, Velocity, and Speed

moderate dose 32.2 Biological Effects of Ionizing Radiation

Modern physics 1.1 Physics: An Introduction

mole 13.3 The Ideal Gas Law

moment of inertia 10.3 Dynamics of Rotational Motion: Rotational Inertia, 10.3 Dynamics of Rotational Motion: Rotational Inertia

motion 3.4 Projectile Motion

Motors 22.8 Torque on a Current Loop: Motors and Meters

muon family number 33.4 Particles, Patterns, and Conservation Laws

Mutual inductance 23.9 Inductance

myopia 26.2 Vision Correction

Ν

natural frequency 16.8 Forced Oscillations and Resonance

near point 26.2 Vision Correction

Nearsightedness 26.2 Vision Correction

negatively curved 34.4 Dark Matter and Closure

Nerve conduction 20.7 Nerve Conduction-Electrocardiograms

net external force 4.3 Newton's Second Law of Motion: Concept of a System

net rate of heat transfer by radiation 14.7 Radiation

neutral equilibrium 9.3 Stability

neutralinos 34.4 Dark Matter and Closure

neutrino 31.4 Nuclear Decay and Conservation Laws

neutrino oscillations 34.4 Dark Matter and Closure

neutron 31.3 Substructure of the Nucleus

Neutron stars 34.2 General Relativity and Quantum Gravity

Neutron-induced fission 32.6 Fission

newton 4.3 Newton's Second Law of Motion: Concept of a System

newton-meters 7.1 Work: The Scientific Definition

Newton's first law of motion 4.2 Newton's First Law of Motion: Inertia, 4.2 Newton's First Law of Motion: Inertia, 4 Section Summary

Newton's second law of motion 4.3 Newton's Second Law of Motion: Concept of a System

Newton's third law of motion 4.4 Newton's Third Law of Motion: Symmetry in Forces, 4 Section Summary

Newton's universal law of gravitation 6.5 Newton's Universal Law of Gravitation

node 17.5 Sound Interference and Resonance: Standing Waves in Air Columns

Nodes 16.10 Superposition and Interference

non-inertial frame of reference 6.4 Fictitious Forces and Non-inertial Frames: The Coriolis Force

nonconservative force 7.5 Nonconservative Forces

normal force 4.5 Normal, Tension, and Other Examples of Forces

north magnetic pole 22.1 Magnets

notes 17.6 Hearing

Nuclear energy 7.6 Conservation of Energy

Nuclear fission 32.6 Fission

Nuclear fusion 32.5 Fusion

nuclear magnetic resonance (NMR) 22.11 More Applications of Magnetism

nuclear radiation 31.1 Nuclear Radioactivity

nuclear reaction energy 31.4 Nuclear Decay and Conservation Laws

nucleons 31.3 Substructure of the Nucleus

nuclide 31.3 Substructure of the Nucleus

Null measurements 21.5 Null Measurements

numerical aperture (NA)(NA) 26.4 Microscopes

O

objective lens 26.4 Microscopes

ohm 20.2 Ohm's Law: Resistance and Simple Circuits

Ohm's law 20.2 Ohm's Law: Resistance and Simple Circuits, 21.1 Resistors in

Series and Parallel

ohmic 20.2 Ohm's Law: Resistance and Simple Circuits

ohmmeters 21.5 Null Measurements

optically active 27.8 Polarization

orbital angular momentum 30.7 Patterns in Spectra Reveal More Quantization

orbital magnetic field 30.7 Patterns in Spectra Reveal More Quantization

order 27.3 Young's Double Slit Experiment

order of magnitude 1.2 Physical Quantities and Units

oscillate Introduction to Oscillatory Motion and Waves

Osmosis 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes

osmotic pressure 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes

Otto cycle 15.3 Introduction to the Second Law of Thermodynamics: Heat Engines and Their Efficiency

overdamped 16.7 Damped Harmonic Motion

overtones 16.10 Superposition and Interference, 17.5 Sound Interference and Resonance: Standing Waves in Air Columns

Ρ

parallel 21.1 Resistors in Series and Parallel

parallel plate capacitor 19.5 Capacitors and Dielectrics

parent 31.4 Nuclear Decay and Conservation Laws

Partial pressure 13.5 Phase Changes

Particle physics Introduction to Particle Physics

particle-wave duality 29.5 The Particle-Wave Duality, 29.8 The Particle-Wave Duality Reviewed

Pascal's principle 11.5 Pascal's Principle

Pauli exclusion principle 30.9 The Pauli Exclusion Principle

percent relative humidity 13.6 Humidity, Evaporation, and Boiling

percent uncertainty 1.3 Accuracy, Precision, and Significant Figures

perfectly inelastic collision 8.5 Inelastic Collisions in One Dimension

period 16.2 Period and Frequency in Oscillations

periodic motion 16.2 Period and Frequency in Oscillations

permeability of free space 22.9 Magnetic Fields Produced by Currents: Ampere's Law

perpendicular lever arm 9.2 The Second Condition for Equilibrium

phase angle 23.12 RLC Series AC Circuits

phase diagrams 13.5 Phase Changes

phase-contrast microscope 27.9 \*Extended Topic\* Microscopy Enhanced by the Wave Characteristics of Light

phon 17.6 Hearing

Phosphorescence 30.5 Applications of Atomic Excitations and De-Excitations

photoconductor 18.8 Applications of Electrostatics

photoelectric effect 29.2 The Photoelectric Effect

photomultiplier 31.2 Radiation Detection and Detectors

photon 29.2 The Photoelectric Effect, 29.4 Photon Momentum

photon energy 29.2 The Photoelectric Effect

photon momentum 29.4 Photon Momentum

physical quantity 1.2 Physical Quantities and Units

Physics 1.1 Physics: An Introduction

pion 33.1 The Yukawa Particle and the Heisenberg Uncertainty Principle Revisited

pit 6.1 Rotation Angle and Angular Velocity

pitch 17.2 Speed of Sound, Frequency, and Wavelength, 17.6 Hearing

Planck's constant 29.1 Quantization of Energy

planetary model of the atom 30.2 Discovery of the Parts of the Atom: Electrons and Nuclei

point charge 18.4 Electric Field: Concept of a Field Revisited

point masses 8.6 Collisions of Point Masses in Two Dimensions

Poiseuille's law 12.4 Viscosity and Laminar Flow; Poiseuille's Law

Poiseuille's law for resistance 12.4 Viscosity and Laminar Flow; Poiseuille's Law

polar molecule 18.6 Electric Forces in Biology, 19.5 Capacitors and Dielectrics

polarization 18.2 Conductors and Insulators, 27.8 Polarization

polarization microscope 27.9 \*Extended Topic\* Microscopy Enhanced by the Wave Characteristics of Light

polarized 18.7 Conductors and Electric Fields in Static Equilibrium, 27.8 Polarization

population inversion 30.5 Applications of Atomic Excitations and De-Excitations

position 2.1 Displacement

positively curved 34.4 Dark Matter and Closure

positron 31.4 Nuclear Decay and Conservation Laws

positron decay 31.4 Nuclear Decay and Conservation Laws

positron emission tomography (PET) 32.1 Diagnostics and Medical Imaging

potential difference 19.1 Electric Potential Energy: Potential Difference, 21.2 Electromotive Force: Terminal Voltage

potential energy 7.4 Conservative Forces and Potential Energy, 7.4 Conservative Forces and Potential Energy

potential energy of a spring 7.4 Conservative Forces and Potential Energy

potentiometer 21.5 Null Measurements

power 7.7 Power, 25.6 Image Formation by Lenses

power factor 23.12 RLC Series AC Circuits

precision 1.3 Accuracy, Precision, and Significant Figures

presbyopia 26.1 Physics of the Eye

pressure 11.3 Pressure, 11.4 Variation of Pressure with Depth in a Fluid, 11.5 Pascal's Principle

probability distribution 29.7 Probability: The Heisenberg Uncertainty Principle

projectile 3.4 Projectile Motion

Projectile motion 3.4 Projectile Motion

Proper length 28.3 Length Contraction

Proper time 28.2 Simultaneity And Time Dilation

proton-proton cycle 32.5 Fusion

protons 18.1 Static Electricity and Charge: Conservation of Charge, 31.3 Substructure of the Nucleus

PV diagram 13.5 Phase Changes

Q

quality factor 32.2 Biological Effects of Ionizing Radiation

quantized Introduction to Quantum Physics

quantum chromodynamics 33.5 Quarks: Is That All There Is?, 33.6 GUTs: The Unification of Forces

quantum electrodynamics 33.2 The Four Basic Forces

Quantum gravity 34.2 General Relativity and Quantum Gravity

quantum mechanical tunneling 31.7 Tunneling

Quantum mechanics 1.1 Physics: An Introduction, Introduction to Quantum Physics

quantum numbers 30.8 Quantum Numbers and Rules

quarks 8.3 Conservation of Momentum, 33.5 Quarks: Is That All There Is?

quasars 34.2 General Relativity and Quantum Gravity

 $\mathbf{R}$ 

rad 32.2 Biological Effects of Ionizing Radiation

Radar 24.3 The Electromagnetic Spectrum

radians 6.1 Rotation Angle and Angular Velocity

radiant energy 7.6 Conservation of Energy

radiation 14.4 Heat Transfer Methods, 14.7 Radiation

radiation detector 31.2 Radiation Detection and Detectors

radio waves Introduction to Electromagnetic Waves, 24.3 The Electromagnetic Spectrum

radioactive 31.1 Nuclear Radioactivity

Radioactive dating 31.5 Half-Life and Activity

radioactivity 31.1 Nuclear Radioactivity

radiolytic products 32.4 Food Irradiation

radiopharmaceutical 32.1 Diagnostics and Medical Imaging

radiotherapy 32.3 Therapeutic Uses of Ionizing Radiation

radius of a nucleus 31.3 Substructure of the Nucleus

radius of curvature 6.1 Rotation Angle and Angular Velocity

range 3.4 Projectile Motion

range of radiation 31.1 Nuclear Radioactivity

rate of conductive heat transfer 14.5 Conduction

rate of decay 31.5 Half-Life and Activity

ray 25.1 The Ray Aspect of Light

Ray tracing 25.6 Image Formation by Lenses

Rayleigh criterion 27.6 Limits of Resolution: The Rayleigh Criterion

RC circuit 21.6 DC Circuits Containing Resistors and Capacitors

real image 25.6 Image Formation by Lenses

reflected light is completely polarized 27.8 Polarization

refraction 25.3 The Law of Refraction

relative biological effectiveness 32.2 Biological Effects of Ionizing Radiation

relative humidity 13.6 Humidity, Evaporation, and Boiling

relative osmotic pressure 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes

relative velocities 3.5 Addition of Velocities

relativistic Doppler effects 28 Section Summary

Relativistic kinetic energy 28.6 Relativistic Energy

Relativistic momentum 28.5 Relativistic Momentum

relativistic velocity addition 28.4 Relativistic Addition of Velocities

Relativity 1.1 Physics: An Introduction, 3.5 Addition of Velocities, 28.1 Einstein's Postulates

Renewable forms of energy 7.9 World Energy Use

resistance 20.2 Ohm's Law: Resistance and Simple Circuits, 21.1 Resistors in Series and Parallel

resistivity 20.3 Resistance and Resistivity

resistor 21.1 Resistors in Series and Parallel, 21.6 DC Circuits Containing Resistors and Capacitors

resonance 16.8 Forced Oscillations and Resonance

resonant 24.2 Production of Electromagnetic Waves

resonant frequency 23.12 RLC Series AC Circuits

resonate 16.8 Forced Oscillations and Resonance

Rest energy 28.6 Relativistic Energy

rest mass 28.5 Relativistic Momentum

restoring force 16.1 Hooke's Law: Stress and Strain Revisited

resultant 3.2 Vector Addition and Subtraction: Graphical Methods

resultant vector 3.2 Vector Addition and Subtraction: Graphical Methods

retinex theory of color vision 26.3 Color and Color Vision

retinexes 26.3 Color and Color Vision

reverse dialysis 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes

Reverse osmosis 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes

reversible process 15.2 The First Law of Thermodynamics and Some Simple Processes

Reynolds number 12.5 The Onset of Turbulence

right hand rule 1 22.4 Magnetic Field Strength: Force on a Moving Charge in a Magnetic Field

right hand rule 2 22.9 Magnetic Fields Produced by Currents: Ampere's Law

right-hand rule 10.7 Gyroscopic Effects: Vector Aspects of Angular Momentum

rms current 20.5 Alternating Current versus Direct Current

rms voltage 20.5 Alternating Current versus Direct Current

rods and cones 26.3 Color and Color Vision

roentgen equivalent man 32.2 Biological Effects of Ionizing Radiation

rotation angle 6.1 Rotation Angle and Angular Velocity

rotational inertia 10.3 Dynamics of Rotational Motion: Rotational Inertia

rotational kinetic energy 10.4 Rotational Kinetic Energy: Work and Energy Revisited, 10.4 Rotational Kinetic Energy: Work and Energy Revisited

RR factor 14.5 Conduction

Rydberg constant 30.3 Bohr's Theory of the Hydrogen Atom, 30.3 Bohr's Theory of the Hydrogen Atom

 $\mathbf{S}$ 

saturation 13.6 Humidity, Evaporation, and Boiling

scalar 2.2 Vectors, Scalars, and Coordinate Systems, 3.2 Vector Addition and Subtraction: Graphical Methods, 19.2 Electric Potential in a Uniform Electric Field

Schwarzschild radius 34.2 General Relativity and Quantum Gravity

scientific method 1.1 Physics: An Introduction

scintillators 31.2 Radiation Detection and Detectors

screening 18.6 Electric Forces in Biology

second 1.2 Physical Quantities and Units

second law of motion 8.1 Linear Momentum and Force

second law of thermodynamics 15.3 Introduction to the Second Law of Thermodynamics: Heat Engines and Their Efficiency, 15.3 Introduction to the Second Law of Thermodynamics: Heat Engines and Their Efficiency, 15.4 Carnot's Perfect Heat Engine: The Second Law of Thermodynamics Restated

second postulate of special relativity 28.1 Einstein's Postulates

Self-inductance 23.9 Inductance

semipermeable 12.7 Molecular Transport Phenomena: Diffusion, Osmosis, and Related Processes, 20.7 Nerve Conduction–Electrocardiograms

series 21.1 Resistors in Series and Parallel

shear deformation 5.3 Elasticity: Stress and Strain

shell 30.9 The Pauli Exclusion Principle

shielding 32.2 Biological Effects of Ionizing Radiation

shock hazard 20.6 Electric Hazards and the Human Body, 23.8 Electrical Safety: Systems and Devices

short circuit 20.6 Electric Hazards and the Human Body

shunt resistance 21.4 DC Voltmeters and Ammeters

SI unit of torque 9.2 The Second Condition for Equilibrium

SI units 1.2 Physical Quantities and Units

sievert 32.2 Biological Effects of Ionizing Radiation

significant figures 1.3 Accuracy, Precision, and Significant Figures

simple circuit 20.2 Ohm's Law: Resistance and Simple Circuits

Simple Harmonic Motion 16.3 Simple Harmonic Motion: A Special Periodic Motion

simple harmonic oscillator 16.3 Simple Harmonic Motion: A Special Periodic Motion

simple pendulum 16.4 The Simple Pendulum

simplified theory of color vision 26.3 Color and Color Vision

single-photon-emission computed tomography (SPECT) 32.1 Diagnostics and Medical Imaging

slope 2.8 Graphical Analysis of One-Dimensional Motion

solenoid 22.9 Magnetic Fields Produced by Currents: Ampere's Law

Solid-state radiation detectors 31.2 Radiation Detection and Detectors

sonic boom 17.4 Doppler Effect and Sonic Booms

sound 17.1 Sound

sound intensity level 17.3 Sound Intensity and Sound Level

sound pressure level 17.3 Sound Intensity and Sound Level

south magnetic pole 22.1 Magnets

space quantization 30.7 Patterns in Spectra Reveal More Quantization

special relativity. 28.1 Einstein's Postulates

specific gravity 11.7 Archimedes' Principle

specific heat 14.2 Temperature Change and Heat Capacity

spin projection quantum number 30.8 Quantum Numbers and Rules

spin quantum number 30.8 Quantum Numbers and Rules

spontaneous symmetry breaking 34.1 Cosmology and Particle Physics

stable equilibrium 9.3 Stability

Standard Model 33.6 GUTs: The Unification of Forces

standing wave 16.10 Superposition and Interference, 24.2 Production of Electromagnetic Waves

static electricity Introduction to Electric Charge and Electric Field

static equilibrium 9.1 The First Condition for Equilibrium, 9.4 Applications of Statics, Including Problem-Solving Strategies

static friction 5.1 Friction

statistical analysis 15.7 Statistical Interpretation of Entropy and the Second Law of Thermodynamics: The Underlying Explanation

Stefan-Boltzmann law of radiation 14.7 Radiation

step-down transformer 23.7 Transformers

step-up transformer 23.7 Transformers

Stimulated emission 30.5 Applications of Atomic Excitations and De-Excitations

Stokes' law 5.2 Drag Forces

strain 5.3 Elasticity: Stress and Strain

strange 33.5 Quarks: Is That All There Is?

strangeness 33.4 Particles, Patterns, and Conservation Laws

stress 5.3 Elasticity: Stress and Strain

sublimation 13.5 Phase Changes, 14.3 Phase Change and Latent Heat

subshell 30.9 The Pauli Exclusion Principle

Superconductors 34.6 High-temperature Superconductors

supercriticality 32.6 Fission

superforce 34.1 Cosmology and Particle Physics

superposition 16.10 Superposition and Interference

Superstring theory 33.6 GUTs: The Unification of Forces, 34.3 Superstrings

surface tension 11.8 Cohesion and Adhesion in Liquids: Surface Tension and Capillary Action

synchrotron 33.3 Accelerators Create Matter from Energy

synchrotron radiation 33.3 Accelerators Create Matter from Energy

system 4.3 Newton's Second Law of Motion: Concept of a System

systolic pressure 11.6 Gauge Pressure, Absolute Pressure, and Pressure Measurement, 11.9 Pressures in the Body

Т

tagged 32.1 Diagnostics and Medical Imaging

tail 3.2 Vector Addition and Subtraction: Graphical Methods

tangential acceleration 10.1 Angular Acceleration

Television 24.3 The Electromagnetic Spectrum

Temperature 13.1 Temperature

temperature coefficient of resistivity 20.3 Resistance and Resistivity

Tensile strength 5.3 Elasticity: Stress and Strain

tension 4.5 Normal, Tension, and Other Examples of Forces

terminal speed 12.6 Motion of an Object in a Viscous Fluid

terminal voltage 21.2 Electromotive Force: Terminal Voltage

tesla 22.4 Magnetic Field Strength: Force on a Moving Charge in a Magnetic Field

test charge 18.4 Electric Field: Concept of a Field Revisited

the second law of thermodynamics stated in terms of entropy 15.6 Entropy and the Second Law of Thermodynamics: Disorder and the Unavailability of Energy

theory 1.1 Physics: An Introduction

theory of quark confinement 33.5 Quarks: Is That All There Is?

therapeutic ratio 32.3 Therapeutic Uses of Ionizing Radiation

thermal agitation 24.3 The Electromagnetic Spectrum

thermal conductivity 14.5 Conduction

thermal energy 7.5 Nonconservative Forces, 7.6 Conservation of Energy, 13.4 Kinetic Theory: Atomic and Molecular Explanation of Pressure and Temperature

thermal equilibrium 13.1 Temperature

thermal expansion 13.2 Thermal Expansion of Solids and Liquids

thermal hazard 20.6 Electric Hazards and the Human Body, 23.8 Electrical Safety: Systems and Devices

Thermal stress 13.2 Thermal Expansion of Solids and Liquids

thin film interference 27.7 Thin Film Interference

thin lens 25.6 Image Formation by Lenses

thin lens equations 25.6 Image Formation by Lenses

thought experiment 34.2 General Relativity and Quantum Gravity

three-wire system 23.8 Electrical Safety: Systems and Devices

thrust 4.4 Newton's Third Law of Motion: Symmetry in Forces, 4 Section Summary

timbre 17.6 Hearing

time 2.3 Time, Velocity, and Speed

Time dilation 28.2 Simultaneity And Time Dilation

TOE epoch 34.1 Cosmology and Particle Physics

tone 17.6 Hearing

top 33.5 Quarks: Is That All There Is?

Torque 9.2 The Second Condition for Equilibrium, 10.3 Dynamics of Rotational Motion: Rotational Inertia

Total energy 28.6 Relativistic Energy

total internal reflection 25.4 Total Internal Reflection

trajectory 3.4 Projectile Motion

transformer equation 23.7 Transformers

Transformers 23.7 Transformers

transverse wave 16.9 Waves, 24.2 Production of Electromagnetic Waves

triple point 13.5 Phase Changes

Tunneling 31.7 Tunneling

turbulence 12.4 Viscosity and Laminar Flow; Poiseuille's Law

U

ultra high frequency 24.3 The Electromagnetic Spectrum

ultracentrifuge 6.2 Centripetal Acceleration

ultrasound 17.6 Hearing

Ultraviolet (UV) microscopes 27.9 \*Extended Topic\* Microscopy Enhanced by the Wave Characteristics of Light

Ultraviolet radiation 29.3 Photon Energies and the Electromagnetic Spectrum ultraviolet radiation (UV) 24.3 The Electromagnetic Spectrum

uncertainty 1.3 Accuracy, Precision, and Significant Figures

uncertainty in energy 29.7 Probability: The Heisenberg Uncertainty Principle uncertainty in momentum 29.7 Probability: The Heisenberg Uncertainty Principle

uncertainty in position 29.7 Probability: The Heisenberg Uncertainty Principle uncertainty in time 29.7 Probability: The Heisenberg Uncertainty Principle underdamped 16.7 Damped Harmonic Motion

uniform circular motion Introduction to Uniform Circular Motion and Gravitation

units 1.2 Physical Quantities and Units

unpolarized 27.8 Polarization

unstable equilibrium 9.3 Stability

up 33.5 Quarks: Is That All There Is?

useful work 7.8 Work, Energy, and Power in Humans

V

Van de Graaff 33.3 Accelerators Create Matter from Energy

Van de Graaff generators 18.8 Applications of Electrostatics

vapor 13.5 Phase Changes

Vapor pressure 13.5 Phase Changes

vector 2.2 Vectors, Scalars, and Coordinate Systems, 3.2 Vector Addition and Subtraction: Graphical Methods, 19.2 Electric Potential in a Uniform Electric Field

vector addition 3.5 Addition of Velocities, 18.5 Electric Field Lines: Multiple Charges

vectors 3.1 Kinematics in Two Dimensions: An Introduction, 18.5 Electric Field Lines: Multiple Charges

velocity 3.5 Addition of Velocities

vertically polarized 27.8 Polarization

very high frequency 24.3 The Electromagnetic Spectrum

virtual image 25.6 Image Formation by Lenses

virtual particles 33.1 The Yukawa Particle and the Heisenberg Uncertainty Principle Revisited

viscosity 12.4 Viscosity and Laminar Flow; Poiseuille's Law

viscous drag 12.6 Motion of an Object in a Viscous Fluid

Visible light 24.3 The Electromagnetic Spectrum, 29.3 Photon Energies and the Electromagnetic Spectrum

voltage 19.1 Electric Potential Energy: Potential Difference, 21.1 Resistors in Series and Parallel

voltage drop 21.1 Resistors in Series and Parallel

Voltmeters 21.4 DC Voltmeters and Ammeters

W

watt 7.7 Power

wave 16.9 Waves

wave velocity 16.9 Waves

wavelength 16.9 Waves, 24.2 Production of Electromagnetic Waves

wavelength in a medium 27.1 The Wave Aspect of Light: Interference

waves Introduction to Oscillatory Motion and Waves

weakly interacting massive particles 34.4 Dark Matter and Closure

weight 4.3 Newton's Second Law of Motion: Concept of a System, 4.5 Normal, Tension, and Other Examples of Forces

Wheatstone bridge 21.5 Null Measurements

WIMPs 34.4 Dark Matter and Closure

work 7.1 Work: The Scientific Definition

work-energy theorem 7.2 Kinetic Energy and the Work-Energy Theorem, 10.4 Rotational Kinetic Energy: Work and Energy Revisited, 10 Section Summary

Χ

xrays 29.3 Photon Energies and the Electromagnetic Spectrum, 30.4 X Rays: Atomic Origins and Applications

X-ray 24.3 The Electromagnetic Spectrum

x-ray diffraction 30.4 X Rays: Atomic Origins and Applications xerography 18.8 Applications of Electrostatics

Y

y-intercept 2.8 Graphical Analysis of One-Dimensional Motion

 $\mathbf{Z}$ 

Zeeman effect 30.7 Patterns in Spectra Reveal More Quantization zeroth law of thermodynamics 13.1 Temperature

zz-component of spin angular momentum 30.8 Quantum Numbers and Rules zz-component of the angular momentum 30.8 Quantum Numbers and Rules