

Young and Freedman: University Physics, Eleventh Edition

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<i>Demo 35-05:</i>	<i>Freezing by Boiling</i>
<i>Demo 35-06:</i>	<i>Cryophorus</i>
<i>Demo 35-07:</i>	<i>Ice Bomb</i>
<i>Demo 35-08:</i>	<i>Regelation</i>
<i>Demo 35-09:</i>	<i>Helium and CO₂ Balloons in Liquid Nitrogen</i>
<i>Demo 35-10:</i>	<i>Sublimation of CO₂</i>

XX
 Demo numbers have not been fixed below here (some exceptions)
 XX

19. The First Law of Thermodynamics

19.1 Thermodynamic Systems

19.2 Work Done During Volume Changes

19.3 Paths Between Thermodynamic States

<i>Demo 35-03</i>	<i>CO₂ Critical Point</i>
<i>Demo 35-05:</i>	<i>Freezing by Boiling</i>
<i>Demo 35-02:</i>	<i>Boil Water Under Reduced Pressure</i>

19.4 Internal Energy and the First Law of Thermodynamics

<i>Demo 34-01</i>	<i>Drill and Dowel</i>
<i>Demo 34-02:</i>	<i>Mechanical Equivalent of Heat</i>

19.5 Kinds of Thermodynamic Processes

19.6 Internal Energy of an Ideal Gas

<i>Demo 36-12</i>	<i>Gaussian Curve</i>
<i>Demo 36-13:</i>	<i>Free Expansion Simulation</i>

19.7 Heat Capacities of an Ideal Gas

19.8 Adiabatic Processes for an Ideal Gas

Demo 34-03: CO₂ Expansion Cooling
Demo 34-04: Adiabatic Expansion
Demo 34-05: Fire Syringe

20. The Second Law of Thermodynamics

20.1 Directions of Thermodynamic Processes

20.2 Heat Engines

Demo 34-06 Stirling Engine
Demo 34-07 Hero's Engine

20.3 Internal-Combustion Engines

20.4 Refrigerators

20.5 The Second Law of Thermodynamics

20.6 The Carnot Cycle

Demo 34-06 Stirling Engine
Demo 36-01 Pressure vs. Volume
Demo 36-02: Pressure vs. Temperature

20.7 Entropy

Demo 32-09 Dust Explosion
Demo 32-10 Scaling Cube

20.8 Microscopic Interpretation of Entropy

21. Electric Charge and Electric Field

21.1 Electric Charge

<i>Demo 39-01</i>	<i>Electrostatic Rods</i>
<i>Demo 39-02</i>	<i>Electrostatic Rod and Cloth</i>
<i>Demo 39-03</i>	<i>Electrostatic Ping-Pong Deflection</i>
<i>Demo 39-04</i>	<i>Electrostatic Ping-Pong Balls</i>
<i>Demo 46-05</i>	<i>Battery and Separable Capacitor</i>
<i>Demo 39-06</i>	<i>Piezoelectric Sparker</i>

21.2 Conductors, Insulators, and Induced Charges

<i>Demo 39-05</i>	<i>Conductors and Insulators</i>
<i>Demo 40-01</i>	<i>Electrostatic Induction</i>
<i>Demo 40-02</i>	<i>Metal Rod Attraction</i>
<i>Demo 40-03</i>	<i>Electrophorus</i>
<i>Demo 40-04</i>	<i>Induction Generator</i>
<i>Demo 40-05</i>	<i>Kelvin Water Dropper</i>

21.3 Coulomb's Law

21.4 Electric Field and Electric Forces

<i>Demo 41-01</i>	<i>Van de Graaff Generator</i>
<i>Demo 41-02</i>	<i>Van de Graaff with Streamers</i>
<i>Demo 41-03</i>	<i>Van de Graaff and Wand</i>
<i>Demo 41-04</i>	<i>Electric Field</i>
<i>Demo 41-05</i>	<i>Lightning Rod</i>
<i>Demo 41-06</i>	<i>Pinwheel</i>
<i>Demo 41-07</i>	<i>Point and Candle</i>
<i>Demo 41-10</i>	<i>Smoke Precipitation</i>
<i>Demo 41-11</i>	<i>Electron Discharge Tube with Wheel</i>

21.5 Electric-Field Calculations

21.6 Electric Field Lines

<i>Demo 41-02</i>	<i>Van de Graaff with Streamers</i>
<i>Demo 41-03</i>	<i>Van de Graaff and Wand</i>
<i>Demo 41-04</i>	<i>Electric Field</i>

21.7 Electric Dipoles

<i>Demo 40-06</i>	<i>Wooden Needle</i>
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22. Gauss' Law

22.1 Electric Charge and Electric Flux

22.2 Calculating Electric Flux

22.3 Gauss' Law

<i>Demo 41-08</i>	<i>Faraday Cage</i>
<i>Demo 41-09</i>	<i>Faraday Ice Pail</i>

22.4 Applications of Gauss' Law

<i>Demo 56-11</i>	<i>Radio in Faraday Cage</i>
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22.5 Charges of Conductors

<i>Demo 41-01</i>	<i>Van de Graaff Generator</i>
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23. Electric Potential

23.1 Electric Potential Energy

23.2 Electric Potential

<i>Demo 41-01</i>	<i>Van de Graaff Generator</i>
<i>Demo 45-02</i>	<i>Battery Effect</i>
<i>Demo 45-04</i>	<i>Electrolysis</i>
<i>Demo 45-05</i>	<i>Electroplating</i>

23.3 Calculating Electric Potential

23.4 Equipotential Surfaces

23.5 Potential Gradient

24. Capacitance and Dielectrics

24.1 Capacitors and Dielectrics

<i>Demo 46-01</i>	<i>Leyden Jars on Toepler Holtz</i>
<i>Demo 46-02</i>	<i>Parallel Plate Capacitor</i>
<i>Demo 46-04</i>	<i>Rotary Capacitor</i>
<i>Demo 46-05</i>	<i>Battery and Separable Capacitor</i>
<i>Demo 46-09</i>	<i>Grounded Leyden Jar</i>
<i>Demo 46-02</i>	<i>Parallel Plate Capacitor Dielectrics</i>
<i>Demo 46-08</i>	<i>Dissectible Capacitor</i>

24.2 Capacitors in Series and Parallel

<i>Demo46-10:</i>	<i>Series/Parallel Capacitors</i>
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24.3 Energy Storage in Capacitors and Electric-Field Energy

<i>Demo46-06:</i>	<i>Exploding Capacitor</i>
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24.4 Dielectrics

<i>Demo 46-07:</i>	<i>Force on a Dielectric</i>
<i>Demo 46-02:</i>	<i>Parallel Plate Capacitor Dielectrics</i>
<i>Demo 46-08</i>	<i>Dissectible Capacitor</i>

24.5 Molecular Model of Induced Charge

24.6 Gauss' Law in Dielectrics

25. Current, Resistance, and Electromotive Force

25.1 Current

Demo 42-05 Electron Motion Model

25.2 Resistivity

Demo 41-01 Neon Bulb Resistivity
Demo 44-02 Carbon and Tungsten Lamps

25.3 Resistance

Demo 42-01 Resistance Wires
Demo 42-03 Heated Wire
Demo 42-04 Cooled Wire
Demo 42-05 Electron Motion Model
Demo 44-02: Carbon and Tungsten Lamps
Demo 45-01 Conductivity of Solutions
Demo 44-03 Diode
Demo 44-04 Rectifier Circuit
Demo 44-05 Transistor Amplifier

25.4 Electromotive Force and Circuits

Demo 42-02 Ohm's Law

25.5 Energy and Power in Electric Circuits

Demo 43-03 Internal Resistance of Batteries
Demo 43-04 Loading by a Voltmeter
Demo 43-05 Voltage Drops in House Wires
Demo 43-06 I^2R Losses
Demo 43-07 Hot Dog Frying

25.6 Theory of Metallic Conduction

26. Direct-Current Circuits

26.1 Resistors in Series and Parallel

Demo 42-06 Series/Parallel Resistors

- Demo 42-07* *Series/Parallel Light Bulbs*
- 26.2 Kirchhoff's Rules
- Demo 43-01* *Voltage Drop Along Wire*
 Demo 43-02 *Sum of IR Drops*
 Demo 42-10 *Conservation of Current*
- 26.3 Electrical Measuring Instruments
- Demo 42-08* *Wheatstone Bridge*
 Demo 42-09 *Galvanometer as Voltmeter and Ammeter*
- 26.4 R-C Circuits
- Demo 46-11* *RC Charging Curve*
 Demo 46-12 *Relaxation Oscillator*
- 26.5 Power Distribution Systems: A Case Study in Circuit Analysis

27. Magnetic Field and Magnetic Forces

- 27.1 Magnetism
- Demo 47-01* *Magnetic Attraction/Repulsion*
 Demo 47-02 *Lodestone*
 Demo 47-03 *Dip Needle*
 Demo 47-05 *Broken Magnet*
 Demo 48-05: *Large Electromagnet*
 Demo 48-06: *Electromagnet with 1.5-V Battery*
 Demo 47-06 *Lowest Energy Configuration*
- 27.2 Magnetic Field
- Demo 47-04* *Magnetic Fields Around Bar Magnets*
 Demo 48-03 *Magnetic Fields Around Currents*
 Demo 48-08 *Biot-Savart Law*
 Demo 50-06 *Ion Motor*
 Demo 50-07 *AC/DC Magnetic Contrast*
 Demo 50-08 *D'Arsonval Meter*
- 27.3 Magnetic Field Lines and Magnetic Flux

27.4 Motion of Charged Particles in a Magnetic Field

<i>Demo 50-03</i>	<i>Deflected Electron Beam</i>
<i>Demo 50-04</i>	<i>Fine Beam Tube</i>
<i>Demo 50-06</i>	<i>Ion Motor</i>

27.5 Applications of Motion of Charged Particles

27.6 Magnetic Force on a Current-Carrying Conductor

<i>Demo 50-01</i>	<i>Jumping Wire</i>
<i>Demo 50-02</i>	<i>Ampere's Frame</i>
<i>Demo 50-05</i>	<i>Barlow's Wheel</i>
<i>Demo 50-08</i>	<i>D'Arsonval Meter</i>
<i>Demo 50-07</i>	<i>AC/DC Magnetic Contrast</i>

27.7 Force and Torque on a Current Loop

<i>Demo 50-02</i>	<i>Ampere's Frame</i>
<i>Demo 50-08</i>	<i>D'Arsonval Meter</i>

27.8 The Direct-Current Motor

<i>Demo 50-09:</i>	<i>DC Motor</i>
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27.9 The Hall Effect

<i>Demo 50-10:</i>	<i>Hall Effect</i>
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28. Sources of Magnetic Field

28.1 Magnetic Field of a Moving Charge

28.2 Magnetic Field of a Current Element

<i>Demo 48-01</i>	<i>Right-Hand Rule</i>
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28.3 Magnetic Field of a Straight Current-Carrying Conductor

<i>Demo 48-03</i>	<i>Magnetic Fields Around Currents</i>
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28.4 Force between Parallel Conductors

Demo 48-07: Pinch Wires

28.5 Magnetic Field of a Circular Current Loop

Demo 48-02 Oersted's Needle

Demo 48-04: Solenoid Bar Magnet

28.6 Ampere's Law

Demo 48-03 Magnetic Fields Around Currents

28.7 Applications of Ampere's Law

28.8 Magnetic Materials

Demo 49-01 Magnetizing Iron by Contact

Demo 49-02: Magnetic Domain Model

Demo 49-03 Magnetizing Iron

Demo 49-04 Demagnetizing Iron by Hammering

Demo 49-05 Barkhausen Effect

Demo 49-07: Permalloy in Earth's Field

Demo 49-08 Paramagnetism and Diamagnetism

Demo 49-09: Dysprosium in Liquid Nitrogen

Demo 49-10 Curie Nickel

Demo 49-11 Curie Temperature Wheel

28.9 Displacement Current

29. Electromagnetic Induction

29.1 Induction Experiments

Demo 51-01 Wire and Magnet

Demo 51-02 10/20/40 Coils with Magnet

Demo 51-07 Inductive Coil with Lamp

Demo 51-08 Thomson's Flying Ring

Demo 52-04 Electromagnetic Can Breaker

29.2 Faraday's Law

<i>Demo 51-01</i>	<i>Wire and Magnet</i>
<i>Demo 51-02</i>	<i>10/20/40 Coils with Magnet</i>
<i>Demo 51-03</i>	<i>Earth Coil</i>
<i>Demo 51-05</i>	<i>AC/DC Generator</i>
<i>Demo 51-06</i>	<i>Current-Coupled Pendula</i>

29.3 Lenz's Law

<i>Demo 51-09</i>	<i>Faraday Repulsion Coil</i>
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29.4 Motional Electromotive Force

<i>Demo 51-04</i>	<i>Faraday Disc</i>
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29.5 Induced Electric Fields

29.6 Eddy Currents

<i>Demo 52-01</i>	<i>Eddy Current Pendulum</i>
<i>Demo 52-02</i>	<i>Arago's Disc</i>
<i>Demo 52-03</i>	<i>Eddy Current Tubes</i>

29.7 Displacement Current and Maxwell's Equations

29.8 Superconductivity

<i>Demo 37-01</i>	<i>Superconductors</i>
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30. Inductance

30.1 Mutual Inductance

<i>Demo 51-10</i>	<i>Two Coils</i>
<i>Demo 51-12</i>	<i>Vertical Primary and Secondary Coils</i>
<i>Demo 54-01</i>	<i>Inductance Spark</i>

30.2 Self-Inductance and Inductors

<i>Demo 51-11</i>	<i>Induction Coil</i>
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Demo 54-01 *Inductance Spark*

30.3 Inductors and Magnetic-Field Energy

Demo 51-11 *Induction Coil*
Demo 54-01 *Inductance Spark*

30.4 The R-L Circuit

Demo 54-02 *Inductor with Lamp on AC*
Demo 54-03 *Lamps in Parallel with Solenoid*

30.5 The L-C Circuit

30.6 The L-R-C Circuit

Demo 55-01 *Driven LRC Circuit*
Demo 55-02 *Damped LRC Circuit*
Demo 55-03 *Tesla Coil*

31. Alternating Current

31.1 Phasors and Alternating Currents

31.2 Resistance and Reactance

Demo 54-02 *Inductor with Lamp on AC*

31.3 The L-R-C Series Circuit

Demo 55-01 *Driven LRC Circuit*
Demo 55-02 *Damped LRC Oscillation*
Demo 55-03 *Tesla Coil*

31.4 Power in Alternating-Current Circuits

Demo 43-05 *Voltage Drops in House Wires*
Demo 43-06 *I^2R Losses*

31.5 Resonance in Alternating-Current Circuits

Demo 55-01 *Driven LRC Circuit*

31.6 Transformers

<i>Demo 51-13</i>	<i>Transformers</i>
<i>Demo 53-01</i>	<i>Hysteresis Curve</i>
<i>Demo 53-02</i>	<i>Hysteresis Waste Heat</i>
<i>Demo 55-03</i>	<i>Tesla Coil</i>

32. Electromagnetic Waves

- 32.1 Maxwell's Equations and Electromagnetic Waves
- 32.2 Plane Electromagnetic Waves and the Speed of Light
- 32.3 Sinusoidal Electromagnetic Waves
- 32.4 Energy and Momentum in Electromagnetic Waves
- 32.5 Standing Electromagnetic Waves

<i>Demo 56-07</i>	<i>Lecher Wires</i>
<i>Demo 56-09</i>	<i>Microwave Standing Waves</i>
- 32.6 The Electromagnetic Spectrum

<i>Demo 63-01</i>	<i>Infrared in Spectrum</i>
<i>Demo 63-02</i>	<i>Colors in Spectral Light</i>
<i>Demo 63-03</i>	<i>Rainbow Disc</i>
<i>Demo 56-05</i>	<i>Radio Waves</i>
<i>Demo 56-08</i>	<i>Microwave Unit</i>
<i>Demo 56-10</i>	<i>Microwave Absorption</i>
<i>Demo 63-04</i>	<i>Newton's Color disc</i>
<i>Demo 63-05</i>	<i>Additive Color Mixing</i>

33. The Nature and Propagation of Light

- 33.1 The Nature of Light

<i>Demo 56-01</i>	<i>Light in a Vacuum</i>
<i>Demo 56-02</i>	<i>Straight Line Propagation</i>
<i>Demo 56-03</i>	<i>Pinhole Camera</i>

Demo 56-04 Inverse Square Law
Demo 56-06 Impossible Triangle

33.2 Reflection and Refraction

Demo 21-12 Refraction of Water Waves
Demo 59-01 Reflection/Refraction from Plastic Block
Demo 59-02 Small Refraction Tank
Demo 59-05 Disappearing Eye Dropper

33.3 Total Internal Reflection

Demo 59-06 Critical Angle/Total Internal Reflection
Demo 59-07 Silver Soot Ball
Demo 59-08 Light Pipes
Demo 59-09 Optical Paths in Fibers
Demo 59-10 Laser Waterfall

33.4 Dispersion

Demo 59-03 Acrylic/Lead Glass Refraction
Demo 59-04 Three Different Prisms

33.5 Polarization

Demo 64-01 Polaroid Sheets Crossed and Uncrossed
Demo 64-02 Polaroids Cut at 45 Degrees
Demo 64-03 Rotation by Polarizing Filter
Demo 64-05 Microwave Polarization
Demo 64-04 Polarization by Reflection
Demo 64-06 Polarization by Double Reflection
Demo 65-03 Optical Activity in Cellophane Tape
Demo 65-02 Polarized Lion
Demo 65-03 Optical Activity in Corn Syrup
Demo 65-04 Polage
Demo 65-05 Photoelastic Stress Figures
Demo 65-07 Quarter Wave Plate
Demo 65-08 Double Refraction in Calcite
Demo 65-09 Liquid Crystal Sheets

33.6 Scattering of Light

Demo 64-07 Polarization by Scattering
Demo 64-08 Artificial Sunset
Demo 65-06 Barbershop Sugar Tube

33.7 Huygens' Principle

34. Geometric Optics and Optical Instruments

34.1 Reflection and Refraction at a Plane Surface

<i>Demo 57-01</i>	<i>Microwave Reflection</i>
<i>Demo 57-02</i>	<i>Diffuse/Specular Reflection</i>
<i>Demo 57-03</i>	<i>Angles of Incidence and Reflection</i>
<i>Demo 57-04</i>	<i>Location of Image</i>
<i>Demo 57-05</i>	<i>Parity Reversal in a Mirror</i>
<i>Demo 57-06</i>	<i>Hinged Mirrors</i>
<i>Demo 57-07</i>	<i>Corner Reflector</i>
<i>Demo 57-08</i>	<i>Barbershop Mirrors</i>
<i>Demo 57-09</i>	<i>Mirror Box</i>

34.2 Reflection at a Spherical Surface

<i>Demo 58-01</i>	<i>Concave and Convex Mirrors</i>
<i>Demo 58-02</i>	<i>Spherical Aberration in a Mirror</i>
<i>Demo 58-03</i>	<i>Energy at a Focal Point</i>
<i>Demo 58-04</i>	<i>Heat Focusing</i>
<i>Demo 58-05</i>	<i>Large Concave Mirror</i>
<i>Demo 60-01</i>	<i>Real Image Formation</i>

34.3 Refraction at a Spherical Surface

34.4 Thin Lenses

<i>Demo 60-02</i>	<i>Lens Magnification</i>
<i>Demo 60-03</i>	<i>Ray Tracing with Lenses</i>
<i>Demo 60-04</i>	<i>Fresnel Lenses</i>
<i>Demo 60-05</i>	<i>Fillable Air Lenses</i>
<i>Demo 60-06</i>	<i>Spherical Aberration</i>
<i>Demo 60-07</i>	<i>Chromatic Aberration</i>
<i>Demo 60-08</i>	<i>Astigmatism</i>
<i>Demo 60-09</i>	<i>Off Axis Distortion</i>

34.5 Camera

34.6 The Eye

34.7 The Magnifier

34.8 Microscopes and Telescopes

35. Interference

35.1 Interference and Coherent Sources

35.2 Two-Source Interference of Light

<i>Demo 62-01</i>	<i>Microwave Double Slit Interference</i>
<i>Demo 62-02</i>	<i>Double Slit Interference</i>

35.3 Intensity in Interference Patterns

35.4 Interference in Thin Films

<i>Demo 62-05</i>	<i>Glass Plates in Sodium Light</i>
<i>Demo 62-06</i>	<i>Newton's Rings</i>
<i>Demo 62-07</i>	<i>Interference Filters</i>
<i>Demo 62-08</i>	<i>Pohl's Mica Sheet</i>
<i>Demo 62-09</i>	<i>Soap Film Interference</i>

35.5 The Michelson Interferometer

<i>Demo 62-10</i>	<i>Microwave Interferometer</i>
<i>Demo 62-11</i>	<i>Michelson Interferometer with White Light</i>

36. Diffraction

36.1 Fresnel and Fraunhofer Diffraction

<i>Demo 61-05</i>	<i>Poisson's Bright Spot</i>
<i>Demo 61-06</i>	<i>Shadow of a Needle</i>
<i>Demo 61-07</i>	<i>Pin Hole Diffraction</i>
<i>Demo 61-08</i>	<i>Knife Edge Diffraction</i>

36.2 Diffraction from a Single Slit

<i>Demo 21:13</i>	<i>Single Slit diffraction of Water Waves</i>
<i>Demo 61-01</i>	<i>Microwave Diffraction</i>
<i>Demo 61-02</i>	<i>Single Slit Diffraction</i>
<i>Demo 61-03</i>	<i>Single Slit Diffraction (Cornell Slides)</i>
<i>Demo 61-04</i>	<i>Thin Wire Diffraction</i>

36.3 Intensity in the Single-Slit Pattern

36.4 Multiple Slits

<i>Demo 62-03</i>	<i>Multiple Slit Interference</i>
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36.5 The Diffraction Grating

<i>Demo 62-04</i>	<i>Interference Gratings</i>
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36.6 X-Ray Diffraction

36.7 Circular Apertures and Resolving Power

<i>Demo 61-09</i>	<i>Resolving Power</i>
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36.8 Holography

<i>Demo 62-12</i>	<i>Holograms</i>
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37. Relativity

37.1 Invariance of Physical Laws

37.2 Relativity of Simultaneity

37.3 Relativity of Time Intervals

37.4 Relativity of Length

37.5 The Lorentz Transformation

37.6 Spacetime Diagrams

37.7 The Doppler Effect for Electromagnetic Waves

37.8 Relativistic Momentum

37.9 Relativistic Work and Energy

38 Photons, Electrons, and Atoms

38.1 Emission and Absorption of Light

<i>Demo 66-01</i>	<i>Radiation Spectrum of a Hot Object</i>
<i>Demo 66-02</i>	<i>Photoelectric Effect in Zinc</i>
<i>Demo 66-08</i>	<i>Bichsel Boxes</i>

38.2 The Photoelectric Effect

<i>Demo 66-04</i>	<i>Solar Cells</i>
<i>Demo 66-02</i>	<i>Photoelectric Effect in Zinc</i>

38.3 Atomic Line Spectra and Energy Levels

<i>Demo 67-01</i>	<i>Emission Spectra</i>
<i>Demo 67-02</i>	<i>Spectral Absorption by Sodium Vapor</i>
<i>Demo 67-07</i>	<i>Flame Salts</i>
<i>Demo 67-03</i>	<i>Thermionic Emission</i>
<i>Demo 67-04</i>	<i>Electron Discharge Tube with Cross</i>
<i>Demo 67-05</i>	<i>Discharge Tube with Vacuum Pump</i>
<i>Demo 67-09</i>	<i>Triboluminescence</i>
<i>Demo 67-10</i>	<i>Luminescence</i>
<i>Demo 67-11</i>	<i>Fluorescence</i>
<i>Demo 67-12</i>	<i>Franck-Hertz Effect</i>
<i>Demo 45-03</i>	<i>Pickle Frying</i>
<i>Demo 67-06:</i>	<i>Plasma Tube</i>

38.4 The Nuclear Atom

<i>Demo 68-01</i>	<i>Rutherford Scattering</i>
<i>Demo 68-02</i>	<i>Nuclear Shielding</i>

<i>Demo 68-03</i>	<i>Mousetrap Chain Reaction</i>
<i>Demo 68-04</i>	<i>Half-Life</i>
<i>Demo 68-05</i>	<i>Cosmic Rays</i>

38.5 The Bohr Model

38.6 The Laser

38.7 X-Ray Production and Scattering

<i>Demo 66-03</i>	<i>X-Ray Ionization</i>
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38.8 Continuous Spectra

<i>Demo 66-01</i>	<i>Radiation Spectrum of a Hot Object</i>
<i>Demo 66-08</i>	<i>Bichsel Boxes</i>

38.9 Wave-Particle Duality

<i>Demo 66-05</i>	<i>Microwave Barrier Penetration</i>
<i>Demo 66-06</i>	<i>Electron Diffraction</i>
<i>Demo 66-07</i>	<i>Millikan Oil Drop</i>

39 The Wave Nature of Particles

39.1 De Broglie Waves

39.2 Electron Diffraction

<i>Demo 66-06</i>	<i>Electron Diffraction</i>
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39.3 Probability and Uncertainty

<i>Demo 36-12</i>	<i>Gaussian Curve</i>
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39.4 Wave Functions

40 Quantum Mechanics

40.1 Particle in a Box

40.2 Potential Wells

40.3 Potential Barriers and Tunneling

Demo 66-05

Microwave Barrier Penetration

40.4 The Harmonic Oscillator

40.5 Three-Dimensional Problems

41 Atomic Structure

41.1 The Hydrogen Atom

41.2 The Zeeman Effect

41.3 Electron Spin

41.4 Many-Electron Atoms and the Exclusion Principle

41.5 X-Ray Spectra

Demo 66-03

X-Ray Ionization

42 Molecules and Condensed Matter

42.1 Types of Molecular Bonds

42.2 Molecular Spectra

42.3 Structure of Solids

Demo 37-02 *Crystal Models*
Demo 37-03 *Faults in Crystals*

42.4 Energy Bands

Demo 38-01 *Thermistor*
Demo 38-02 *Thermoelectric Magnet*
Demo 38-03 *Thermoelectric Heat Pump*
Demo 38-04 *Thermocouple*

42.5 Free-Electron Model of Metals

Demo 42-05 *Electron Motion Model*

42.6 Semiconductors

Demo 44-03 *Diode*

42.7 Semiconductor Devices

Demo 44-04 *Rectifier Circuit*
Demo 44-05 *Transistor Amplifier*

42.8 Superconductivity

Demo 37-01 *Superconductor*

43 Nuclear Physics

43.1 Properties of Nuclei

43.2 Nuclear Binding and Nuclear Structure

Demo 68-01 *Rutherford Scattering*

43.3 Nuclear Stability and Radioactivity

Demo 68-02 *Nuclear Shielding*
Demo 68-03 *Mousetrap Chain Reaction*
Demo 68-05 *Cosmic Rays*

43.4 Activities and Half-Lives

Demo 68-04 *Half-Life*

43.5 Biological Effects of Radiation

43.6 Nuclear Reactions

Demo 68-02 *Nuclear Shielding*
Demo 68-03 *Mousetrap Chain Reaction*
Demo 68-05 *Cosmic Rays*

43.7 Nuclear Fission

Demo 68-03 *Mousetrap Chain Reaction*

43.8 Nuclear Fusion

44 Particle Physics and Cosmology

44.1 Fundamental Particles – a History

44.2 Particle Accelerators and Detectors

44.3 Particles and Interactions

44.4 Quarks

44.5 The Standard Model and Beyond

44.6 The Expanding Universe

44.7 The History of the Universe
