Scope & Sequence

Lesson 1: Introduction to Physics

- "Laws" of physics
- Proportions and mathematical models
- Measurement and units
- Graphing as a modeling tool

Lesson 2: A Brief History of Physics

- Natural philosophy
- Classical physics
- Modern physics
- Aristotle, Galileo, Newton, and Einstein

Lesson 3: Vibrations & Waves

- Vibrations and energy
- Period, frequency, and wavelength
- Amplitude
- Interference
- Wave equation

Lesson 4: Sound Waves

- Medium of transmission
- Speed of sound
- Interference and acoustics
- Doppler effect

Lesson 5: Light & Color

- Electromagnetic waves and the electromagnetic spectrum
- Energy, frequency, and wavelength
- Rods and cones
- Color absorption and emission

Lesson 6: Wave Optics

- Reflection and refraction
- Mirrors and lenses
- Lensmaker's equation

Lesson 7: Temperature & Heat

- Thermal energy
- Absolute vs relative temperature
- Melting, freezing, boiling, and condensing
- State vs temperature and pressure
- Heat capacity

Lesson 8: Heat Transfer

- Conservation of energy
- Conduction, convection, and radiation
- Newton's law of cooling

Lesson 9: Thermodynamics

- Three laws of thermodynamics
- Entropy
- "Zeroth" law of thermodynamics
- Heat cycles
- Engines

Lesson 10: Exam 1

Lesson 11: Linear Motion (Part 1)

- Frame of reference and measuring motion
- Speed, direction, and velocity
- Distance vs time graphs
- Constant motion

Lesson 12: Linear Motion (Part 2)

- Changing motion, acceleration
- Average speed vs instantaneous speed
- Distance and velocity
- Acceleration graphs
- Acceleration due to gravity

Lesson 13: Two-Dimensional Motion

- Vectors/2-D math
- Changing direction as acceleration
- Solving simultaneous equations
- Projectile motion
- Circular motion

Lesson 14: Newton's Laws of Motion

- Newton's first law
- Inertia and mass
- Newton's second law
- Cause and effect
- Newton’s second law
- Newton's third law

Lesson 15: Specific Forces

- Gravity
- “Normal” force
- Friction and air resistance
- Pressure and force
- Centripetal force

Lesson 16: Momentum

- Defining momentum
- Momentum and Newton's 2nd law
- Law of conservation of momentum
- Closed systems and collisions

Lesson 17: Energy of Motion

- Defining and measuring energy
- Potential and kinetic energy
- Conservation of energy

Lesson 18: Rotational Motion

- Similarity between rotational and linear motion
- Rotational speed and acceleration
- Linear motion as part of rotational motion

Lesson 19: Rotational Mechanics

- Force vs torque
- Mass vs rotational inertia
- Rotational inertia of various solid shapes
- Newton's laws in rotation

Lesson 20: Exam 2

Lesson 21: Electrostatics

- Electric charge
- Polarization
- Scientific Notation
- Coulomb's law and problem solving

Lesson 22: Electric Fields

- Electric potential
- Potential differences
- Fields of point charges
- Fields of surfaces and shapes
- Capacitors

Lesson 23: Electric Current

- Conventional current
- Conductors vs resistors
- Closed vs open circuits
- Potential and voltage
- Ohm's law

Lesson 24: Series & Parallel Circuits

- Circuit diagrams and features
- Series vs parallel definitions
- Ohm's law in series and parallel

Lesson 25: Magnetism

- North vs South
- Strength of force and magnetic fields
- Magnetic equations

Lesson 26: Electromagnetism

- Moving charges
- Changing fields
- Interconnectivity
- Right-hand rule

Lesson 27: Exam 3

Lesson 28: Special Relativity pt. 1

- Classical relativity
- Spacetime
- Time dilation and time travel
- Lorentz Transformation

Lesson 29: Special Relativity pt. 2

- Length Contraction
- Energy and Momentum
- Mass-Energy Equivalence

Lesson 30: Universal Gravitation

- Kepler’s laws of planetary motion
- Newton's law of gravity
- Einstein’s general relativity

Lesson 31: Atomic & Nuclear Physics

- Atomic structure
- Nuclear radiation (Alpha, Beta, Gamma)
- Nuclear fission and fusion

Lesson 32: Quantum Physics

- What is a quanta?
- The photoelectric effect
- Electron Energy Levels
- Planck's constant
- Planck scale and quanta

Lesson 33: Quantum Uncertainty & Probability

- Heisenberg uncertainty
- Quantum Tunneling
- Noether’s Theorem
- Schrodinger’s Wave Equations
- Schrodinger’s Cat

Lesson 34: Wave/Particle Duality

- Photons as Particle and Wave
- Two-Slit Interference of light
- Observer Effect/Paradox
- de Broglie Wavelengths
- Two-Slit Interference of other Particles

Lesson 35: Exam 4