

Typical Physics 1 syllabus (Mechanics) and suitable PhET Sims.

- 0) Algebra, trigonometry, unit conversion, taking derivatives
Graphing Lines (HTML) / Calculus Grapher / Trig Tour (HTML)
- 1) 1D Kinematics : x , v , a vs t graphs, constant acceleration formulas
The Moving Man / Ramp: Forces and Motion / Calculus Grapher
- 2) Vector math: addition and subtraction of vectors, components of a vector
Vector Addition / Trig Tour (HTML)
- 3) Motion in 2D: Vector acceleration, v_1 - v_2 - Δv diagrams, 2D projectile motion, circular motion
Vector Addition / Projectile Motion (HTML) / Lunar Lander / Motion in 2D / Maze Game / Ladybug Revolution / Pendulum Lab (HTML)
- 4) Newton's Laws, free-body diagrams, kinetic and static friction
Force and Motion: Basics (HTML) / Forces and Motion / Forces in 1 dimension / Ramp: Forces and Motion / Friction (HTML) / Torque / Masses and Springs (HTML soon) / Hooke's Law (HTML)
- 5) $F_{\text{net}} = ma$ problems: FBDs, coordinate systems, $\sum F_x = ma_x$, $\sum F_y = ma_y$
Force and Motion: Basics (HTML) / Forces and Motion / Pendulum Lab (HTML) / Torque / Projectile Motion (HTML)
- 6) Work and energy, KE and PE, conservation of energy, power
Masses and Springs (HTML soon) / Pendulum Lab (HTML) / Hooke's Law (HTML) / Energy Skate Park: Basics (HTML) / Energy Skate Park (HTML in 2019) / The Ramp
- 7) Gravity: $F_{\text{grav}} = GMm/r^2$, $g = GM/r^2$, orbits, escape velocity
Force Law Lab (HTML) / My Solar System / Gravity and Orbits (HTML)
- 8) Conservation of linear momentum; impulse = $\Delta p = F_{\text{net}} \Delta t$
Collision Lab
- 9) Rotational motion: θ , ω , α ; torque $\tau = r F_{\perp}$; $\tau = I \alpha$; $KE_{\text{tot}} = KE_{\text{trans}} + KE_{\text{rot}}$
Ladybug Revolution / Torque / Motion in 2D / Ladybug Motion 2D
- 10) Conservation of Angular Momentum, $\vec{L} = \vec{r} \times \vec{p}$, $\vec{L} = I \vec{\omega}$, $\vec{L}_{\text{tot}} = \text{constant}$ if $\vec{\tau}_{\text{ext}} = 0$
Torque
- 11) Static Equilibrium: $\sum F_x = 0$, $\sum F_y = 0$, $\sum \tau = 0$
Balancing Act (HTML)
- 12) Simple Harmonic Motion: $\omega = 2\pi/T = \sqrt{k/m}$, damped, driven SHO
Masses and Springs (HTML soon) / Pendulum Lab (HTML) / Resonance
- 13) Fluids: density ρ , pressure p , buoyant force / Archimedes' Principle
Buoyancy / Balloons and Buoyancy / Fluid Pressure and Flow / Under Pressure (HTML)
- 14) Traveling waves, sound waves, $v_{\text{wave}} = \lambda f$, Superposition Principle, standing waves
Wave on a String (HTML) / Sound / Wave Interference (HTML in 2019) / Fourier: Making Waves
- 15) Thermo: specific heat c , $\Delta Q = m c \Delta T$ or $\Delta Q = m L$, ideal gases, heat transfer mechanisms
Friction (HTML) / States of Matter (HTML) / Gas Properties (HTML in 2019) / Blackbody Spectrum (HTML soon)

Typical Physics 2 syllabus (E&M, Optics) and suitable PhET Sims.

- 1) Coulomb's Laws and E-fields
Vector Addition / Charges and Fields (HTML) / Balloons and Static Electricity (HTML) / John Travoltage (HTML) / Electric Field Hockey
- 2) Gauss's Law
Charges and Fields (HTML)
- 3) Voltage
Energy Skate Park (for review of work and energy) / **Charges and Fields (HTML)**
- 4) Capacitance
Capacitor Lab / Capacitor Lab: Basics (HTML)
- 5) Electric Current: Ohm's Law, resistance and resistivity, simple circuits, power
Ohm's Law (HTML) / Resistance in a Wire (HTML) / Battery-Resistor Circuit / Circuit Construction Kit DC (HTML)
- 6) DC circuits: series and parallel elements, ammeters and voltmeters
Circuit Construction Kit DC (HTML)
- 7) RC circuits
Circuit Construction Kit (AC+DC) / Capacitor Lab: Basics (HTML)
- 8) Magnetism I: Lorentz Force Law, forces on current-carrying wires, motors
- 9) Magnetism II: Sources of the B-field, Biot-Savart Law, Gauss's Law for B-fields, Ampere's Law, permanent magnets
Magnet and Compass / Magnets and Electromagnets
- 10) Faraday's Law: emf, Lenz's Law, generators, eddy currents
Faraday's Law (HTML) / Faraday's Electromagnetic Lab / Generator
- 11) Inductors, Transformers, LC and LRC circuits
Faraday's Electromagnetic Lab / Circuit Construction Kit(AC+DC) / Generator
- 12) Electromagnetic Waves, polarization of light
Wave on a String (as mechanical example of transverse wave) / **Radiating Charge Radio Waves and Electromagnetic Field / Blackbody Radiation (HTML soon) / Fourier: Making Waves**
- 13) Ray optics: reflection, Snell's Law, lenses and image formation, camera and eye
Bending Light (HTML) / Geometric Optics / Color Vision (HTML)
- 14) Physical optics: Diffraction and Interference
Bending Light (HTML) / Wave Interference (HTML in 2019) / Fourier: Making Waves