

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

- 0) Algebra, trigonometry, unit conversion, taking derivatives
Graphing Lines / Calculus Grapher / Trig Tour
- 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
- 3) Motion in 2D: Vector acceleration, v_1 - v_2 - Δv diagrams, 2D projectile motion, circular motion
**Vector Addition / Projectile Motion / Lunar Lander / Motion in 2D / Maze Game
Ladybug Revolution / Pendulum Lab**
- 4) Newton's Laws, free-body diagrams, kinetic and static friction
**Forces and Motion / Forces in 1 dimension / Ramp: Forces and Motion / Friction / Torque
Hooke's Law**
- 5) $\mathbf{F}_{\text{net}} = m\mathbf{a}$ problems: FBDs, coordinate systems, $\sum F_x = ma_x$, $\sum F_y = ma_y$
Forces and Motion / Pendulum Lab / Torque
- 6) Work and energy, KE and PE, conservation of energy, power
Masses and Springs / Pendulum Lab / Energy Skate Park / The Ramp / Hooke's Law
- 7) Gravity: $F_{\text{grav}} = GMm/r^2$, $g = GM/r^2$, orbits, escape velocity
Force Law Lab / My Solar System / Gravity and Orbits
- 8) Conservation of linear momentum; impulse = $\Delta \mathbf{p} = \mathbf{F}_{\text{net}} \Delta t$
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
- 12) Simple Harmonic Motion: $\omega = 2\pi/T = \sqrt{k/m}$, damped, driven SHO
Masses and Springs / Pendulum Lab / Resonance
- 13) Fluids: density ρ , pressure p , buoyant force / Archimedes' Principle
Buoyancy / Balloons and Buoyancy / Fluid Pressure and Flow / Under Pressure
- 14) Traveling waves, sound waves, $v_{\text{wave}} = \lambda f$, Superposition Principle, standing waves
Wave on a String / Sound / Wave Interference / 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 / States of Matter / Gas Properties / Blackbody Spectrum

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

- 1) Coulomb's Laws and E-fields
**Vector Addition / Charges and Fields / Balloons and Static Electricity / John Travoltage
Electric Field Hockey**
- 2) Gauss's Law
Charges and Fields
- 3) Voltage
Energy Skate Park (for review of work and energy) / **Charges and Fields**
- 4) Capacitance
Capacitor Lab
- 5) Electric Current: Ohm's Law, resistance and resistivity, simple circuits, power
**Ohm's Law / Resistance in a Wire / Battery-Resistor Circuit /
Circuit Construction Kit (DC Only)**
- 6) DC circuits: series and parallel elements, ammeters and voltmeters
Circuit Construction Kit (DC Only)
- 7) RC circuits
Circuit Construction Kit (AC+DC)
- 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 / 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 / Fourier: Making Waves**
- 13) Ray optics: reflection, Snell's Law, lenses and image formation, camera and eye
Bending Light / Geometric Optics / Color Vision
- 14) Physical optics: Diffraction and Interference
Bending Light / Wave Interference / Fourier: Making Waves