

AP Mechanics:

Kinematics

TOPICS:

Vectors, Vector Algebra, Components of Vectors, Coordinate systems, displacement, velocity, acceleration and their calculus relationships, reference frames.

Motion in 1, 2, 3 dimensions

LABS:

Gravity Lab, Instantaneous vs. Average Acceleration, Motion detector lab, Projectile Motion lab

Newton's Laws of Motion

TOPICS:

Newton's three laws and applications including tension and angles etc.

LABS:

Newton's 2nd law lab parts I, II, Friction Lab, Atwood Machine Lab, Hook's Law Lab

Work, Energy, Power

TOPICS:

Work Energy Power, calculus relationships to force and distance

LABS:

Personal Power, Conservation of Energy, Target lab

Linear Momentum

TOPICS:

Momentum, impulse, calculus relationships to force and time

LABS:

Bentley Van Push, Conservation of Momentum

Circular Motion (covered briefly with Newton's laws and kinematics as well)

TOPICS:

Circular acceleration, Force, banked curve problems, tension

Labs:

Circular motion lab

Oscillations and Gravitation:

TOPICS:

Orbits, elliptic and circular equations, Simple Harmonic motion, mass on spring, pendulums ideal and real, laws of gravitation

LABS:

Pendulum Lab, Simple Harmonic oscillator.

Rotational Motion

TOPICS:

Rotational analogs to all previous topics using moment of inertia and angular momentum, torque etc.

LABS:

Rotational inertia of a yo-yo

Review and combining topics:

Structured review of intertwined topics with use of previous AP questions.

Post AP: dependent on student interest in various topics.

AP Physics Electricity and Magnetism

Electrostatics

TOPICS:

Static electricity, Coulombs Law, Charge, Electric Fields, Voltage, Potential, point charges, charge distributions, planar, cylindrical, spherical symmetries, Gauss's law. Divergence, Gradient, Curl

LABS:

Voltage and electric field mapping.

Capacitors, Conductors, Dielectrics

TOPICS:

Capacitors, Conductors, Dielectrics and how they adjust the previous equations.

LABS:

Building a Leyden Jar (capacitor)

Electric Circuits

TOPICS:

Voltage, Resistance Current, charging capacitors, time constants

LABS:

Adding Resistors in parallel and series, charging capacitors, temperature dependent resistance (violating Ohm's law)

Magnetostatics

Topics:

Forces on moving charges, current carrying wires, fields due to current carrying wires, Biot-Savart's Law, Ampere's Law.

Labs:

Calculate the forces in class demo's current carrying wire, looking at magnetic fields of various geometries with iron fillings.

Electromagnetism

TOPICS:

Electromagnetic Induction, Faraday's law, Lenz's law, inductors, inductors in circuits, Maxwell's equations electromagnetism in everyday objects, AC Circuits.

LABS:

Build a speaker, Build an electromagnet, Low Pass filter, High Pass filter.

Advanced mathematical tinkering

TOPICS: Maxwell's laws in multivariable calculus form, further problems, CGS units.

Review and combining topics:

Spend a few weeks checking out old AP problems and looking at old problems with new tools as well as combining topics as far back as AP Mechanics.

Post AP: Dependent on Student interest in various topics.

Physics

Kinematics (motion)

Topics: displacement, velocity, acceleration, vectors, graphical interpretations, projectile motion, relative frames of reference.

Labs: Ave. vs Instantaneous velocity, Motion Detector lab, gravity lab

Dynamics (Newton's Laws)

Topics: Newton's three laws and their applications, torque

Labs: Newton's 2nd law lab, friction lab, circular motion lab, torque balancing

Work, Energy and Power

Topics: Work, Energy, conservation, power

Labs: Target Lab, Conservation of energy lab, personal power

Momentum

Topics: Impulse, momentum, how it relates to energy and force, graphical analysis

Labs: conservation of momentum, Bentley van push.

Gravity and Rotational Motion

Topics: Strange world of rotational motion, gyroscopes, tops, conservation of angular momentum, gravity between planets, orbits (circular)

Buoyancy and Bernoulli

Topics: Boats, airplanes and sailboats, why stuff floats, various devices that employ these principles.

Labs: Bernoulli investigation, buoyancy lab

Sound

Topics: Waves, open/closed pipe resonance, strings, musical instruments, Doppler effect, sonic booms, speed of sound, decibels, harmonies, energy in a sound wave.

Labs: Slinky lab, Tune a cardboard tube (Project-build a musical instrument)

Optics and Light

Topics: plane, concave, convex mirrors and the images (real and virtual) they produce. Glasses and eyes, index of refraction, splitting of light, color mixing, prisms, quantum effects, double slit refraction, polarization, rearview mirrors.

Labs: Find the image (3 parts, one for each mirror). Measure index of refraction of water and oil.

Electricity

Topics: Coulombs law, ohms law, DC circuits, heat, common household objects that use electricity, AC

Labs: Adding resistors, building simple circuits.

Magnetism

Topics: Earth's magnetic field, compass, magnetism's relation to electricity, household objects that use magnetism

Labs: build a speaker, build a compass, investigate a TV.

Modern Physics

Topics: Relativity, Quantum world, forefront of physics, shape of the universe, radioactive decay, blackbody radiation.