

AP[®] Physics B

AP[®] Physics B is intended to provide a rigorous introductory college level physics course with laboratory activities for high school students. The following course materials are in no way intended to replace the extensive materials provided by the College Board. The AP[®] course outline and recommended laboratory experiences are revised periodically by the College Board. The teacher of this course should have the most current copy of the AP[®] Physics B course description book and materials from the College Board. These materials are available at the AP Central website <http://apcentral.collegeboard.com>.

Inquiry is applied to the study of matter and energy and their interaction. Learners will study natural and technological systems. The program strands and unifying concepts provide a context for teaching content and process skill goals.

All goals should focus on the unifying concepts:

- Systems, Order and Organization
- Evidence, Models, and Explanation
- Constancy, Change, and Measurement
- Evolution and Equilibrium
- Form and Function

Strands: The strands are: Nature of Science, Science as Inquiry, Science and Technology, Science in Personal and Social Perspectives. They provide the context for teaching of the content Goals and Objectives.

COMPETENCY GOAL 1: The learner will develop abilities necessary to do and understand scientific inquiry.

Objectives

- 1.01 Identify questions and problems that can be answered through scientific investigations.
- 1.02 Design and conduct scientific investigations to answer questions about the physical world.
 - Create testable hypotheses
 - Identify variables.
 - Use a control or comparison group when appropriate.
 - Select and use appropriate measurement tools.
 - Observe and measure real phenomena
 - Collect and record data.
 - Organize data into charts and graphs.
 - Analyze and interpret data.
 - Determine uncertainties in measurements.
 - Communicate findings.

- 1.03 Formulate and revise scientific explanations and models using logic and evidence to:
- Explain observations.
 - Make inferences and predictions from data and observations.
 - Explain the relationship between evidence and explanation.
 - Communicate results, including suggested ways to improve experiments and proposed questions for further study.
- 1.04 Apply safety procedures in the laboratory and in field studies:
- Recognize and avoid potential hazards.
 - Safely manipulate materials and equipment needed for scientific investigations.
- 1.05 Analyze reports of scientific investigations of physical phenomena from an informed scientifically literate viewpoints including considerations of:
- Adequacy of experimental controls.
 - Replication of findings.
 - Alternative interpretations of the data.

COMPETENCY GOAL 2: The learner will build an understanding of Newtonian mechanics

- 2.01 Analyze and evaluate a particle using kinematics (movement in one, two, and circular dimensions).
- Motion in one dimensions.
 - Relate position, velocity, and acceleration of a particle for motion.
 - Motion in two dimensions.
 - Addition and subtraction of displacement and velocity vectors
 - Visual, graphical, mathematical expressions of the motion of a projectile in a uniform gravitational field.
 - Relate a particles radius, speed, velocity, and acceleration in uniform circular motion.
- 2.02 Investigate, measure, and analyze Newton's laws of motion
- Static equilibrium (first law).
 - Dynamics of a single particle (second law).
 - Systems of two or more bodies (third law).
 - Velocity with constant force and average force.
 - Force diagram.
 - Normal and frictional forces.
 - Action and reaction forces an two or more bodies (third law).
 - Tension.
- 2.03 Examine and calculate work, energy and power.
- Work and work-energy theorem.
 - Conservative forces and potential energy.
 - Conservation of energy.
 - Power.
- 2.04 Analyze and evaluate systems of particles and linear momentum.
- Impulse and momentum.
 - Conservation of linear momentum and collisions.

- 2.05 Evaluate and analyze circular motion and rotation.
 - Uniform circular motion.
 - Torque and rotational statics.
- 2.06 Investigate and analyze oscillations and gravitation.
 - Simple harmonic motion (dynamics and energy relationships).
 - Mass on a spring.
 - Pendulum and other oscillations.
 - Newton's law of gravity.
 - Circular orbits of planets and satellites.

COMPETENCY GOAL 3: The learner will build an understanding of fluid mechanics and thermal physics.

- 3.01 Examine and evaluate fluid mechanics.
 - Hydrostatic pressure.
 - Buoyancy.
 - Fluid flow continuity.
 - Bernoulli's principle.
- 3.02 Evaluate and investigate temperature and heat.
 - Mechanical equivalent of heat.
 - Heat transfer and thermal expansion.
- 3.03 Examine and evaluate kinetic theory and thermodynamics.
 - Ideal gases-kinetic model and ideal gas law.
 - Laws of thermodynamics-first law (including processes on PV diagrams) and second law (including heat engines).

COMPETENCY GOAL 4: The learner will build an understanding of electricity and magnetism.

- 4.01 Study and analyze electrostatics.
 - Charge, field, and potential.
 - Coulomb's law and field and potential of point charges.
 - Planar fields and potentials of other charge distributions.
- 4.02 Evaluate and analyze conductors, capacitors, and dielectrics.
 - Electrostatics with conductors.
 - Parallel plate capacitors.
- 4.03 Analyze and investigate electric circuits.
 - Current, resistance, and power.
 - Steady-state direct current circuits with batteries and resistors only.
 - Steady-state capacitors in circuits.
- 4.04 Study and evaluate magnetostatics.
 - Forces on moving charges in magnetic fields.
 - Forces on current-carrying wires in magnetic fields.
 - Fields of long current-carrying wires.
- 4.05 Measure and analyze electromagnetism.
 - Electromagnetic induction (including Faraday's law and Lenz's law).

COMPETENCY GOAL 5: The learner will build an understanding of waves and optics.

- 5.01 Study and evaluate wave motion.
 - Properties of traveling waves.
 - Properties of standing waves.
 - Doppler effect.
 - Superposition.
- 5.02 Evaluate and analyze physical optics.
 - Interference and diffraction.
 - Dispersion of light and the electromagnetic spectrum.
- 5.03 Investigate and analyze geometric optics.
 - Reflection and refraction.
 - Mirrors.
 - Lenses.

COMPETENCY GOAL 6: The learner will build an understanding of atomic and nuclear physics.

- 6.01 Analyze and evaluate atomic physics and quantum effects.
 - Photons and the photoelectric effects.
 - Atomic energy levels.
 - Wave-particle duality.
- 6.02 Evaluate, measure, and analyze nuclear physics.
 - Nuclear reactions (including conservation of mass number and charge).
 - Mass-energy equivalence.