AP® Physics B

Course Goals

Course goals include developing each student's intuition, creativity and investigative skills to do the following: (abbreviated from the 2006-07 College Board AP Physics Course Description)

- Read, understand, and interpret physical information.
- Use the scientific method to analyze a particular physical phenomenon or problem.
- Use basic mathematical reasoning in a physical situation or problem.
- Perform experiments, interpret the results of observations and communicate results, including uncertainty assessment.

The course consists of 12 units (italicized in the Course Outline that follows), with a test at the completion of each unit. Homework is assigned every night and is reviewed the next day. Labs are done at a time to best reinforce the relationships and concepts currently being studied. Throughout the course, emphasis is placed more on the concepts and method of solution or analysis, and less on the actual final product or answer.

Grading Policy

Tests-35%

There will be a test at the end of each unit. Tests can include material from reading assignments, labs, or homework. Each test will largely consist of free-response problems.

Quizzes-25%

There will be one or two quizzes in each chapter, consisting of questions and problems from the unit currently being studied.

Labs-25%

Students will be placed in lab groups of 4 or less individuals. Each student is responsible for their own lab write up to be completed in a composition notebook. Graphs and regressions are to be done on analytical software such as TI-Interactive, LoggerPro, or Excel, printed and placed into the lab write-up. A lab grading rubric will be included with student lab book. Each write-up must include:

- The objective or purpose of lab
- Data tables
- Analysis of data which includes graphs and discussion
- Conclusion including error analysis

Students are required to keep the reports in composition notebooks in case the college of their choice requires evidence, artifacts or documentation prior to awarding college credit for physics.

Homework-15%

Reading assignments, and daily questions and problems will be assigned to help students learn each unit. Not every assignment will be graded, but student may be called on to present their work to the class for review

As we get closer to May, the emphasis shifts towards preparing for the AP Physics exam by reviewing released exams, past free-response questions and test-taking skills.

Textbooks

Primary textbook:

Giancoli, D. (2005). *Physics: Principles with Applications,* 6th rev. ed. Upper Saddle River, NJ: Prentice-Hall. ISBN 0-13-184661-2

Supplemental Resource: (used to be primary textbook):

Jones/Childers. (1993). *Contemporary College Physics*, 2nd ed.: Addison-Wesley. ISBN 0-201-54266-8

Course Outline

Unit 1: Math and Data Review (1.5 weeks)

A. Data collection and analysis
    1. TI Interactive
    2. LoggerPro
B. Vector addition
    1. Graphical methods
    2. Algebraic methods (non-right triangles)
C. Significant figures
    1. Measurement
    2. rules

I. NEWTONIAN MECHANICS

Unit 2: Kinematics (2.5 weeks)

A. Motion in One Dimension
    1. Position-time and velocity-time graphs
    2. Equations of motion under constant acceleration
B. Motion in Two Dimensions - Projectiles

Unit 3: Newton's Laws (3.5 weeks)

A. Static Equilibrium (First Law)
    1. Translational equilibrium
    2. Rotational equilibrium
B. Dynamics of a Single Body (Second Law)
C. Systems of Two or More Bodies (Third Law)
D. Universal Gravitation

E. Applications
    1. Inclined planes
    2. Atwood's machines
    3. Static and kinetic friction
    4. Horizontal and vertical circles
    5. Planets and satellites

Unit 4: Work, Energy, Power & Momentum (3.5 weeks)

A. Work and Work-Kinetic Energy Theorem
B. Conservative Forces and Potential Energy
    1. Gravity
    2. Springs
C. Conservation of Mechanical Energy
D. Power
E. Momentum
    1. Impulse-Momentum Theorem
    2. Conservation of Linear Momentum and Collisions
        a. Elastic and inelastic collisions
        b. One and two-dimensional collisions
    3. Angular acceleration and momentum
        a. torque
        b. rotational kinetic energy

II. FLUIDS MECHANICS & THERMAL PHYSICS

Unit 5: Fluid Mechanics (2 weeks)

A. Density and pressure
    1. Density and specific gravity
    2. Pressure as a function of depth
    3. Pascal's Law
B. Buoyancy – Archimedes' Principle
C. Fluid flow continuity
D. Bernoulli's equation
E. Applications
    1. Hydraulics
    2. Flight
    3. Plumbing and sprinkler systems

Unit 6: Thermal Physics (2.5 weeks)

A. Temperature and Thermal Effects
    1. Mechanical equivalent of heat
    2. Heat transfer and thermal expansion
        a. linear expansion of solids
        b. volume expansion of solids and liquids
    3. Calorimetry
B. Kinetic Theory, Ideal Gases & Gas Laws
C. Thermodynamics

1. First Law of Thermodynamics
2. Second Law of Thermodynamics
    a. Heat engines
    b. Refrigerators, heat pumps

III. ELECTRICITY & MAGNETISM

Unit 7: Electrostatics (2.5 weeks)

A. Coulomb's Law
B. Electric Fields and Gauss' Law
C. Electric Potential Energy and Electric Potential
D. Capacitance

Unit 8: Current Electricity (2 weeks)

A. Emf, Current, Resistance and Power
B. DC circuits
    1. Series and parallel circuits
    2. Batteries and internal resistance
    3. Ohm's Law and Kirchhoff's rules
    4. Voltmeters and ammeters
    5. Capacitors in circuits (RC circuits)

IV. WAVES & OPTICS

Unit 9: Wave motion and Sound (1.5 weeks)

A. Simple harmonic motion and pendulums.
B. Standing waves and resonance
C. Sound intensity, power and relative sound intensity
D. Interference
E. The Doppler Effect (in one dimension)

Unit 10: Optics (2.5 weeks)

A. Geometric Optics
    1. Reflection, Refraction and Snell's Law
        a. Reflection and refraction at a plane surface
        b. Total internal reflection
    2. Images formed by mirrors
    3. Images formed by lenses
    4. Ray Diagrams and the thin lens/mirror equation
B. Physical Optics
    1. The electromagnetic spectrum
    2. Interference and path difference
    3. Interference effects and diffraction

V. ATOMIC & NUCLEAR PHYSICS

Unit 11: Modern Physics (2.5 weeks)

A. Atomic Physics and Quantum Effects
    1. Photons and the Photoelectric effect
    2. X-ray production
    3. Electron energy levels-fluorescence and lasers

B. Nuclear Physics
    1. Atomic mass, mass number, atomic number
    2. Mass defect and nuclear binding energy
    3. Nuclear processes
        a. modes of radioactive decay (α, β, γ)
        b. fission
        c. fusion
    4. Mass-Energy Equivalence and Conservation of Mass and Energy

Labs

area	General area of study	order	Specific topic	Lab Title		min
I	Mechanics	1	gravity	Determining Gravity on an Incline	student hands on	55
I	Mechanics	2	projectile motion	Projectile Motion	student hands on	55
I	Mechanics	3	Newtons Laws	Constant Force and Motion	student hands on	110
I	Mechanics	4	friction	Getting to Know Mu	student hands on	55
I	Mechanics	5	power	Determining your personal power output	student hands on	35
I	Mechanics	6	circular motion	Centripetal Acceleration on a Turntable	student hands on	55
I	Mechanics	7	Hooke's Law	Determining the force constant of a spring	student hands on	35
II	Fluids	1	buoyancy	Archimedes Principle	student hands on	55
II	Thermodynamics	1	Linear expansion	Linear Expansion	student hands on	55
III	Electricity & Magnetism	1	electrostatics	Induced charge	Student hands on	55
III	Electricity & Magnetism	2	electric fields	Electric fields	student hands on	55
III	Electricity & Magnetism	3	circuits	Ohm's Law	student hands on	55
IV	Waves	1	speed of sound	Resonance: The speed of sound	student hands on	55
IV	Optics	1	refraction	Determining the index of refraction of glass	student hands on	55

IV	Optics	2	geometric optics	Converging lenses	student hands on	55
IV	Optics	3	interference	Diffraction and Interference	student hands on	55
V	Modern	1	radioactivity	Radioactivity	student hands on	55