AP Physics B Mrs. White
Old Town High School 2007-2008

Objective

The purpose of this course is to prepare students to successfully complete the Physics B College Board Advanced Placement Examination on May 12, 2008. Regular class attendance and diligent daily work will afford students the opportunity to succeed.

Textbook: *Physics*, Cutnell and Johnson, 4th Edition – 1998, John Wiley & Sons
Supplemental Texts: *Physics*, Serway and Faughn, 4th Edition
Tutorials in Introductory Physics, L.C. McDermott, P.S. Shaffer, and the Physics Education Group at the University of Washington, First Edition – 2002, Prentice Hall.

Course Description

The Advanced Placement Physics B is an algebra-based course in general Physics. The syllabus is designed by the College Board. The course is equivalent to two semesters of an introductory algebra-based university-level physics course. Laboratory work is an essential part of the course and will take place during regular class meeting time.

The course meets on an alternating day schedule, generally resulting in five class meetings in every two weeks. Each class period is either 78 or 39 minutes in duration, so the course meets for a total of 117 minutes every other day. In addition, students are expected to cover some material as a guided independent study prior to the start of the school year.

Labs are generally conducted during the 78-minute period. Most laboratory investigations are inquiry based and student-driven, i.e., students are given an objective and asked to design an investigation to meet the objective. These investigations give students the opportunity to develop critical thinking skills and use guided inquiry to build their knowledge of the topics. This type of laboratory experience also prepares students for the lab-based questions in the second portion of the AP Exam. Students are required to keep a laboratory notebook that includes all hypotheses, procedures, data, and analyses. Notebooks are collected weekly during the first month of school and then prior to the end of each ranking period for review and evaluation.

Grades in this course will be based on student performance on exams (# per semester), laboratory reports, and homework.

Course Outline

I. INTRODUCTION (summer work & 1 week)
   A. Unit Conversion
   B. Scalars & Vectors

II. NEWTONIAN MECHANICS

A. Kinematics (3 weeks)

1. Linear Motion
    a. Position-time and velocity-time graphs
    b. Equations of motion
2. Motion in Two Dimensions
    a. Equations of motion in two-dimensions
    b. Vectors
    c. Graphical Analyses
    d. Circular motion
3. Labs
    a. Determination of the acceleration due to gravity (80 min)
    b. Analysis of projectile motion and its component vectors (117 min)

B. Newton's Laws (4 weeks)

1. Newton's First Law
    a. First Condition
    b. Second Condition
2. Newton's Second Law
3. Newton's Third Law
4. Universal Gravitation
5. Labs
    a. Motion on an inclined plane (80 min)
    b. Friction (80 min)

C. Work, Energy, Power (2 weeks)

1. Work and the Work Energy Theorem
    a. Kinetic Energy
    b. Force graphs
2. Conservation of Energy

D. Linear momentum (1 week)

1. Impulse & momentum
2. Collisions and conservation of linear momentum
3. Lab
    a. Darts make the cars go (45 min)

E. Simple Harmonic Motion (2 weeks)

1. Springs & Pendulums
2. Energies of Simple Harmonic Motion
3. Graphs
4. Labs
    a. Determination of spring constants by experimentation (117 min)

F. Rotational dynamics and equilibrium (2 week)
    1. Torque
    2. Angular momentum
    3. Conservation of Angular momentum
        a. Application to Universal gravitation
    4. Lab
        a. Spinning stool = spinning student

III. HEAT, KINETIC THEORY, THERMODYNAMICS

A. Fluid Mechanics (2 week)
    1. Hydrostatic Pressure
    2. Archimedes' Principle
    3. Fluid flow continuity
    4. Bernoulli's Principle
    5. Lab
        a. Density determination based on buoyancy (80 min)

B. Thermal Physics (2 weeks)
    1. Temperature & Heat
        a. Mechanical equivalent of heat
        b. Heat transfer and thermal expansion
        c. Specific heat, Heat of Fusion, Heat of Vaporization
    2. Kinetic Theory & Thermodynamics
        a. Ideal gases
        b. Laws of Thermodynamics

IV. ELECTRICITY & MAGNETISM

A. Electrostatics (2 weeks)
    1. Coulomb's Law
    2. Electric fields
    3. Gauss' Law
    4. Electric Potential
    5. Capacitance

B. Electric Circuits (2 weeks)
    1. Current, Resistance, Power
    2. DC Circuits
        a. Series & Parallel Circuits
        b. Internal Resistance & Batteries
        c. Ohm's Law
        d. Kirchhoff's Rules
    3. Capacitors

4. Lab
    a. Using circuits to investigate Ohm's law (80 min)

C. Electromagnetism (1 week)
    1. Magnetostatics
        a. Forces on moving charges in magnetic fields
        b. Forces on current-carrying wires in magnetic fields
        c. Fields of long current-carrying wires
    2. Electromagnetic Induction

V. WAVES & OPTICS

A. Waves (2 week)
    1. Wave motion
        a. Superposition
        b. Interference
    2. Standing waves
    3. Sound
    4. Doppler Effect
    5. Labs
        a. Wave motion & interference (80 min)

B. Physical Optics (2 weeks)
    1. Electromagnetic Spectrum & Dispersion
    2. Interference
        a. Single-slit
        b. Double-slit
        c. Diffraction
        d. Thin films
    3. Labs
        a. Interference (80 min)

C. Geometric Optics (2 weeks)
    1. Reflection
    2. Refraction
    3. Mirrors
        a. Plane
        b. Spherical
    4. Lenses
        a. Converging
        b. Diverging
    5. Labs
        a. Index of refraction determination (80 min)
        b. Focal length determination (80 min)

VI. MODERN PHYSICS

A. Atomic Physics and Quantum Effects (2 weeks)
   1. Properties of photons
   2. Photoelectric effect
   3. Electron energy levels
   4. DeBroglie wavelength
   5. Compton scattering

B. Nuclear Physics (1 week)
   1. Atomic mass, mass number, atomic number
   2. Nuclear force
   3. Nuclear fission & fusion
   4. Mass-energy equivalence