AP® Physics B - Syllabus #1

Text: *Physics*, Cutnell & Johnson; 6th Ed. New York: John Wiley

About the AP Physics B Course:
(Lecture-Discussion MWF 50 min each; Labs Tuesdays 2 hours)
The Advance Placement Physics B is algebra-based course in general Physics. Its syllabus is designed by the College Board. It is equivalent introductory algebra-based university level physics course. This course will be covered in two semesters. The emphasis in the course is on understanding of the concepts and skills at using the concepts and formulae to solve problems. Laboratory work will be covered as an integral part of this course.

Evaluation:	Quizzes	40%
	Homework	20%
	Lab	20%
	Final Exam	20%

Calendar:

Aug. 9 – 18
Introduction
Units and Dimensions
Scalars and Vectors
Motion in one Dimension
Projectile Motion **[C1]**

Aug. 21 – Sept. 8
Newton's Laws of Motion
Weight and Weightlessness
Friction
Inclined Plane **[C1]**

C1 - Course Requirement 1: The course provides instruction in each of the five content areas outlined in the Course Description: Newtonian mechanics

Sept. 13 – 22
Uniform Circular Motion
Newton's Law of Gravitation
Circular Orbits **[C1]**

Sept. 25 – Oct. 13
Work, Energy, and Power
Conservation of Energy
Conservation of Mechanical Energy **[C1]**

Oct. 16 – 20
Linear Momentum
Impulse-Momentum Theorem
Law of Conservation of Linear Momentum **[C1]**

Oct. 23 – 27
Torque
Mechanical Equilibrium
Angular Momentum
Law of Conservation of Angular Momentum
[C1]

Oct. 30 – Nov.6
Simple Harmonic Motion
Graphs of SHM
Simple Pendulum
Spring-Mass system **[C1]**

Nov. 8 – 17
Hydrostatics
Fluid Pressure
Pascal's Principle
Archimedes Principle **[C2]**

Nov. 27 – Dec. 1
Fluid Dynamics
Continuity Equation
Bernoulli's Equation **[C2]**

Dec 4 – 8
Heat
Temperature
Thermal Expansion
Heat Transfer **[C2]**

January 9 - 23
Ideal Gas Laws and PV diagrams
Kinetic Theory and rms speed of gas molecules
Avogadro's number and Boltzmann's constant
First law of Thermodynamics
Reversible Thermodynamic Processes
Heat Engines and Carnot Cycle
Second Law of Thermodynamics
Entropy **[C2]**

January 25 - February 17:
Electrostatics
Coulomb's Law
Electric Field
Motion of Charged Particle in Electric Field
Electric Potential Energy and Electric Potential
Capacitors **[C3]**

C1 - Course Requirement 1: The course provides instruction in each of the five content areas outlined in the Course Description: Newtonian mechanics

C2 - Course Requirement 2: The course provides instruction in each of the five content areas outlined in the Course Description: Fluid mechanics and Thermal Physics mechanics

C3 - Course Requirement 3: The course provides instruction in each of the five content areas outlined in the Course Description: Electricity and Magnetism

Electric Current, Resistance, and EMF
Electrical Resistivity, Power, and Energy
Resistors in Series and Parallel
Kirchoff's Rules
Magnetic Fields
Magnetic Force on Electric Current
Magnetic Field due to I
Magnetic Flux
Electromagnetic Induction **[C3]**

C3 - Course Requirement 3: The course provides instruction in each of the five content areas outlined in the Course Description: Electricity and Magnetism

February 20 – February 27

Traveling Waves
Properties of Sound
Standing Wave and Beats
Doppler Effect

March 1 - March 29

Reflection: Law of Reflection
Refraction
- Snell's Law
- Total Internal Reflection

Image Formation by Plane and Spherical Mirrors
Image Formation by Lenses
Image Formation by a Two-Lens System

Interference
- Superposition Principle
- Double-Slit Interference
- Thin Film
- Newton's Rings
- Non-reflective Coating for Glass

Diffraction
- Single Slit
- Double Slit: Superposition of Interference and Diffraction Patterns
- Diffraction grating

Polarization: Qualitative
Electromagnetic Spectrum
Inverse Square Law **[C4]**

C4 - Course Requirement 3: The course provides instruction in each of the five content areas outlined in the Course Description: Waves and Optics

March 31- April 19

Photoelectric Effect
Energy and Linear Momentum of Photon
Energy Levels in an Atom
- Ionization Energy
- Emission Spectrum
- Absorption Spectrum
- Lasers

DeBroglie Hypothesis: Davisson-Germer experiment
Production of X-rays
Compton Effect
Nuclear Symbols: Mass Number and Atomic Number
Nuclear Reactions
α, β, and γ decay
Neutrino
Nuclear Forces
Nuclear Fission and Chain Reaction
$E = mc^2$ and applications to Nuclear Reactions **[C5]**

C5 - Course Requirement 3: The course provides instruction in each of the five content areas outlined in the Course Description: Atomic and nuclear physics

April 21 – 28 Review of the Fall Semester material
May 1 - 5 Review of the Spring Semester material
May 8 - 12 Academy Finals

Laboratory: All lab experiments are "hands-on" activities. Students will be required to keep a lab notebook containing all of their lab reports. [C7]

Fall lab experiments
1. Indirect measurement of inaccessible heights and distances
2. Areas, Volumes, and densities of given solids and liquids
3. Prediction and reproduction of kinematics graphs with motion detector
4. Determination of acceleration due to gravity
5. Projectile Motion – Relationship between θ and Range
6. Elastic Force in Rubber Bands – Nonlinear spring
7. Inclined Plane – Coefficient of friction
8. Uniform Circular Motion – Relationships between F_c and r
9. Conservation of Mechanical Energy Spring-mass system – Air Track
10. Conservation of Linear Momentum – Air Track
11. Spring-Mass System – Force sensor
12. Simple Pendulum - Photogate
13. Density Using Archimedes Principle
14. Dependence of Cooling Rate on Surface/Volume Ratio

C7 - Course Requirement 7: The course includes a laboratory component comparable to college-level physics laboratories, with a minimum of 12 student-conducted laboratory investigations representing a variety of topics covered in the course. A hands-on laboratory component is required. Each student should complete a lab notebook or portfolio of lab reports. Note: Online course providers utilizing virtual labs (simulations rather than hands-on) should submit their laboratory materials for the audit. If these lab materials are determined to develop the skills and learning objectives of hands-on labs, then courses which use these labs may receive authorization to use the "AP" designation. Online science courses authorized to use the "AP" designation will be posted on the AP Central Web site.

Spring Labs Experiments
1. Electrostatics – Ordering the given materials in the order of their electro negativity
2. Mapping Electric Fields I: Plotting equipotential and field lines
3. Mapping Electric Field II: 3-D Landscape
4. Ohm's Law and Internal Resistance
5. Resistors in Series and Parallel
6. Standing Waves on a String
7. Standing Waves for sound in a pipe
8. Verification of the Laws of Reflection and Refraction
9. Image formation by Spherical Mirrors and Lenses
10. Young's Double-Slit Experiment
11. Single Slit Diffraction and Diameter of Hair
12. Photoelectric Effect

At appropriate points in the course, each of the above laboratory investigations will be presented to the students in the form of a problem. Very often a demonstration of a physical phenomenon will be presented to the class and an explanation of the event will be requested. Students will be encouraged to discuss, confer, and debate about possible solutions to the problem – to form hypotheses. In the course of this discussion, they are to identify the variables that are at work in the phenomenon and then to decide how those variables may be manipulated given the available equipment and time. They are then to develop ways of isolating and manipulating these variables so as to test their hypotheses – to design an experiment. Groups of students may be formed to test different variables. Observations and, whenever possible, measured data will be taken from these tests. Results will be presented to the class and judgments will be made as to what conclusions can be drawn from the data, including possible experimental errors and how the experiment could be improved or expanded. Lastly, the students will be presented with the modern, "accepted" explanation or "expected" result. The students are then to discuss possible reasons for their variation from the expected result (error analysis). Students will produce a formal report summarizing the following:

Problem/question

Hypothesis
Experimental procedure
Data/observations
Calculations
Conclusion and error analysis **[C6]**

C6 - Course Requirement 6: The course utilizes guided inquiry and student-centered learning to foster the development of critical thinking skills.