AP Physics B Course Syllabus and Framework 2011/12

Textbook:
Giancoli, Douglas C. (2005). *Physics: Principles with Applications* (6th ed.). Upper Saddle River, NJ, USA: Prentice Hall.

Course Overview

"This course provides a systematic introduction to the main principles of physics and emphasizes the development of conceptual understanding and problem-solving ability using algebra and trigonometry." -CollegeBoard.com

Our course will meet all the requirements to prepare our students for the Physics B exam given by College Board on Monday, May 14th at noon. The successful completion of this exam qualifies students for possible college/university credit. Our course will be constructed on collaborative learning, discussion, demonstrations and laboratories. Assessments will include midterm and semester exams, chapter tests, homework assignments and a lab component. The course outline below is the curriculum provided by the College Board. The percentages show the approximate coverage of that topic on the AP Physics B Exam. Corresponding chapters in the textbook have also been listed.

Course Outline

I. Mechanics (Giancoli Chapters 2,4,5,6,7,8,11)
- A. Kinematics ~ 11%
  1. Motion in one dimension
  2. Motion in two dimensions
     a. Projectile motion
     b. Uniform circular motion
- B. Newton's Laws of Motion ~ 9%
  1. Static equilibrium — 1st law
  2. Dynamics of a single particle — 2nd law
  3. Systems of two or more bodies — 3rd law
- C. Work, energy and power ~ 5%
  1. Work and the work-energy theorem
  2. Conservative forces and potential energy
  3. Conservation of energy
  4. Power
- D. Systems of particles, linear momentum ~ 4%
  1. Impulse and momentum
  2. Conservation of linear momentum, collisions
- E. Circular Motion and Rotation ~ 4%
  1. Uniform Circular Motion
  2. Angular Momentum and its Conservation
  3. Torque and Rotational Statics
- F. Oscillations and Gravitation ~ 6%
  1. Simple harmonic motion
  2. Mass on a Spring
  3. Pendulum
  4. Law of Universal Gravitation
  5. Satellite Motion

II. Heat, Kinetic Theory, and Thermodynamics (Giancoli Chapters 10,13,14,15)
- A. Fluid Mechanics ~ 5%
  1. Hydrostatic Pressure
  2. Buoyancy
  3. Fluid Flow Continuity
  4. Bernoulli's Equation
- B. Temperature and Heat ~ 3%
  1. Mechanical equivalent of heat
  2. Specific and latent heat
  3. Heat transfer and thermal expansion
- C. Kinetic Theory and Thermodynamics ~ 7%
  1. Ideal gases
  2. Kinetic model
  3. Ideal gas law
  4. Laws of thermodynamics
     a. First law (PV diagrams)
     b. Second Law (heat engines)

III. Waves and Optics (Giancoli Chapters 11,23,24)
- A. Wave motion (sound and physical optics) ~ 10%
  1. Properties of traveling and standing waves
  2. Doppler effect
  3. Superposition
  4. Interference and diffraction
  5. Dispersion of light and the electromagnetic spectrum
- B. Geometric optics ~ 5%
  1. Reflection and refraction
  2. Mirrors
  3. Lenses

IV. Electricity and Magnetism (Giancoli Chapters 16-21)
- A. Electrostatics ~ 5%
  1. Charge, field, and potential
  2. Coulomb's law and point charge field and potential
- B. Conductors and capacitors ~ 4%
  1. Electrostatics with conductors
  2. Capacitors — Parallel plates
- C. Electric circuits ~ 7%
  1. Current, resistance, power
  2. Direct current circuits
- D. Magnetostatics ~ 4%
  1. Forces on moving charges in magnetic fields
  2. Forces on current carrying wires in magnetic fields
  3. Fields of long current carrying wires
  4. Electromagnetic induction and waves ~ 5%

V. Modern Physics (Giancoli Chapters 27,30)

A. Atomic physics and quantum effects ~ 10%

1. Alpha particle scattering and Rutherford model
2. Photons and the photoelectric effect
3. Bohr model
4. Wave particle duality

B. Nuclear physics ~ 5%

1. Radioactivity and half-life
2. Nuclear reactions
3. Mass and energy effects

Homework

Homework will be assigned weekly so that students will become familiar with the content and develop better problem-solving skills. Homework questions will be taken from AP Physics B released tests in addition to questions from textbooks. Many problems will have several different ways they can be solved. Students should look for novel solutions to share with the class when homework is reviewed. Emphasis will be placed on problem-solving skills and approach rather than just simply arriving at the correct answers. Students will be expected to show all work and justify answers using mathematics, graphs, motion maps, free-body diagrams, schematics, and other representational tools.

Learning Physics and Pedagogy

Research has shown that physics is best learned using experimentation and inquiry methods. Students need to construct their own understanding with help from the teacher. In this course, students will interact daily with each other and the instructor using inquiry and Socratic discourse.

Each new topic will be introduced with a question about or observation of an event. Students will decide, with the teacher's guidance, what variables could affect one particular aspect of the event. After discussing the possible effects, students will design an experiment to test two or more variables related to the event. Data will be graphed, manipulated (if needed), and then analyzed by the students. Students will present their conclusions to the class. Discussion (including slope, y-intercept, and integral of graphs; experimental procedure and error) will assist students in understanding the new-found relationships, determining any limiting factors, and writing equations. The Socratic-style discussion following the lab allows students to draw conclusions, ask questions, and refine what they understand from the lab. Formal lab reports will be written and turned in following each lab.

The application of newly-learned concepts to new situations will occur during problem-solving sessions. During these sessions, students will solve multiple-step problems and discuss their solutions with the class. Additional depth or clarification of topics will be provided by the teacher during these sessions.

Each student will complete a portfolio of 19 lab reports. Processing skills are emphasized during labs and will utilize approximately 20% of instructional time.

These skills include:

- planning experiments
- collecting data
- graphing techniques
- analysis of data
- drawing conclusions
- communicating results
- determining sources of error and reducing errors
- problem solving

Laboratory experiments will be conducted every week, with a few exceptions. All nineteen laboratory experiments can be previewed in the list of laboratory experiments. Twelve laboratories will be performed during a double period or over two days. This component will constitute 15% of your overall class grade.

Evaluation

Homework	----------	20 %
Quizzes	----------	40 %
Lab	----------	15 %
Exam	----------	20 %
Participation	----------	5 %
Total	----------	100 %

Semester 1 Framework

Weeks	Unit of Study
Week 1 Sep. 1- Sep. 2	Routines, Policies, Prerequisite Check Vector Hunt Lab
Week 2 Sep. 5- Sep. 9	Ch2 - Kinematics Measure g Lab
Week 3 Sep. 12- Sep. 16	Ch3 - Projectile Motion Cannon Man Lab
Week 4 Sep. 19- Sep. 23	Ch4 - Dynamics Rough Stuff Lab
Week 5 Sep. 26- Sep. 30	Ch6 - Energy Conservation Atwood's Challenge Lab
Week 6 Oct.3-7	Holiday
Week 7 Oct.10-14	Ch7 - Momentum Colossus of Collisions Lab
Week 8 Oct.17-21	Ch5 - Circular Motion Ch8 - Torque Centripetal Force Lab
Week 9 Oct.24-28	Ch11 - Oscillations
Week 10 Oct.31- Nov.4	Review & Midterm Exam
Week 11 Nov.7-11	Ch10 - Fluids Floating on Air Lab
Week 12 Nov.14-18	Ch14 - Heat Burning up and down the House Lab
Week 13 Nov.21-25	Ch13 - Ideal Gases Ch 15 - Entropy, Efficiency & Carnot
Week 14 Nov.28-Dec.2	Review & Unit Test
Week 15 Dec.5-9	Ch 11 - Wave Motion Spots Lab
Week 16 Dec.12-16	Ch 24 - Interference & Diffraction Funny Fishbowl Lab
Week 17 Dec.19-23	Ch 23 - Reflection & Refraction Focal length quest Lab
Week 18 Dec.26-30	First Semester Revision AP Practice Materials and Scoring Guides
Week 19 Jan.2-6	Review & Semester Exam

Semester 2 Framework

Weeks	Unit of Study
Week 1 Feb.6-10	Chapter 16: Electrostatics Van de Graaff Lab
Week 2 Feb.13-17	Chapter 17: Electric Potential
Week 3 Feb.20-24	Chapter 18: Electric Current Circuit Conundrums Lab
Week 4 Feb.27-Mar.2	Chapter 19: DC Circuits Mapping Electric Fields Lab
Week 5 Mar.5-9	Chapter 20: Magnetism Cake pan of Capacitance Lab
Week 6 Mar.12-16	Chapter 21: EMF and Induction Induction Instruction Lab
Week 7 Mar.19-23	EM Review & Exam
Week 8 Mar.26-30	Chapter 27: Atomic and Quantum Physics Millikan's Oil Drop Lab
Week 9 Apr.2-6	Chapter 30: Nuclear Physics Photoelectric Effect Simulation Lab
Week 10 Apr.9-13	Review & Midterm Exam
Week 11 Apr.16-20	Review: Focus on Mechanics
Week 12 Apr.23-27	Review: Focus on Electricity & Magnetism
Week 13 Apr.30-May4	Review & Mock Exam
Week 14 May7-11	AP Exams
Week 15 May14-18	AP Exams
Week 16 May21-25	Final Projects
Week 17 May28-June1	Final Projects
Week 18 June 4-8	Final Projects
Week 19 June 11-15	Final Projects Presentations

List of Laboratory Experiments

#	Lab	Purpose	Type	Periods (40 min)
1	Vector Hunt	To review the use of and calculations associated with vector quantities.	Hands-on	2
2	Measure g	Find creative ways to measure the value of g.	Hands-on	1
3	Cannon Man	Determine the relationship between direction and range of projectiles.	Hands-on	1
4	Rough Stuff	Experimentally verify the coefficient of friction of various materials.	Hands-on	2
5	Atwood's Challenge	Explore multiple-body dynamic systems.	Hands-on	2
6	Colossus of Collisions	Verify the conservation of energy and momentum in different types of collisions.	Hands-on	2
7	Centripetal Force	Discover the relationship between centripetal force and tangential velocity.	Hands-on	1
8	Floating on Air	Determine the density of various objects using different methods.	Hands-on	1
9	Burning up and down the House	Explore the workings of simple heat engines; verify the conversion heat energy to mechanical energy.	Hands-on	3
10	Spots	Use diffraction gratings to characterize different light sources.	Hands-on	1
11	Funny Fishbowl	Exploring refraction and dispersion with water.	Hands-on	2
12	Focal length quest	Determine the focal length of mirrors and lenses with some limitations.	Hands-on	2
13	Van de Graaff	Charging objects in different ways.	Both	1
14	Circuit Conundrums	Measure the properties of unknown circuit components and mystery circuits.	Hands-on	2
15	Maps	Mapping electric fields.	Hands-on	2
16	Cake pan of Capacitance	Build and measure the properties of home-made capacitors.	Hands-on	2
17	Induction Instruction	Build a model to verify Lenz's Law.	Hands-on	2
18	Millikan's Oil Drop	Repeat Millikan's famous experiment to measure properties of the electron.	Hands-on	2
19	Photoelectric Effect Simulation	To simulate running Einstein's famous experiment through an online program.*	Virtual	1
Total = 19 labs				

* http://phet.colorado.edu/new/simulations/sims.php?sim=Photoelectric_Effect