

ADVANCED PLACEMENT PHYSICS B SYLLABUS

Description of Course:

Welcome to Advanced Placement Physics B. AP Physics B is a college level physics course that utilizes algebra and trigonometry but does not incorporate Calculus. The level is equivalent to what many Pre-Med students take in college. We will meet Monday through Friday for 56 minutes each period. In addition, it is strongly recommended that you plan on attending at least one of the teacher's office hours per week in order to get help with the homework, lab analysis, etc.

This year we will study the structure and behavior of matter in an analytical way. As the most fundamental science, Physics is critical to the study of all other sciences. The course is broken into two portions, the classroom portion and the lab portion.

- The classroom portion will utilize a variety of techniques in order to develop each student's critical thinking and problem solving skills. These include but are not limited to direct teacher instruction, guided individual and group inquiry as well as group problem solving exercises, and individual/group presentation of solutions. [C6]
- The lab portion will help develop both an understanding of the physics concepts as well as the ability to design and utilize an open-ended inquiry based method of exploration. These labs will require students to analyze data in a variety of methods including data tables and graphs in order to develop higher level thinking skills. [C6, C7]

Resources:

- Physics: Principles with Applications 6th ed, Giancoli
- Interactive Lecture Demonstrations
- It is strongly recommended that you buy a Prep Guide. These guides give additional practice as well as a good summary of information.

Types of Assignments:

- Daily Homework
- Tests
- Quizzes (especially reading and homework quizzes)
- Labs
- Projects & Presentations

Grades:

20% homework

20% Labs and Team Projects

60% Quizzes, Tests, and Final Exam

A	93% +	C+	77-80%	D-	60-63%
A-	90-93%	C	73-77%	F	0-60%
B+	87-90%	C-	70-73%		
B	83-87%	D+	67-70%		
B-	80-83%	D	63-67%		

TOPIC	CHAPTERS	DATE	STANDARD
Semester 1:			
Kinematics Motion in 1-D Motion in 2-D	chp 2, 3	8/27-9/12	[C1]
Newton's Law Static equilibrium Dynamics	chp 4, chp 9	9/13-9/28	[C1]
Conservation of Momentum Impulse and momentum Conservation of momentum Collisions	chp 7	9/31-10/12	[C1]
Conservation of Energy Work and Work-Energy Theorem Potential Energy Conservation of Energy Power	chp 6	10/15-10/26	[C1]
Rotational Motion & Gravity Uniform Circular Motion Torque Newton's Law of Gravity	chp 5	10/29-11/2	[C1]
Electrostatics Coulomb's Law Electric Field Electric Potential Conductors & Capacitors	chp 16, chp 17	11/5-11/16	[C3]
Electric Current & Circuits Current, Resistance, Power DC circuits	chp 18, 19	11/19-12/7	[C3]
Magnetostatics Forces on moving charges Forces on current carrying wires Fields of long current carrying wires	chp 20	12/10-12/14	[C3]
Electromagnetic Induction & Waves Induced currents Lenz's Law	chp 21, chp 22	12/17-12/21	[C3]
Review, Practice, Winter Break, and Final		12/21-1/18	

Semester 2:

Fluids	chp 10	1/28-2/1	[C2]
Density and Pressure			
Buoyancy			
Fluid Flow			
Bernoulli's equation			
Kinetic Theory	chp 13	2/4-2/6	[C2]
Ideal gases			
Thermodynamics	chp 14, 15	2/7-2/15	[C2]
Mechanical equivalent of heat			
Specific heat and latent heat			
Heat & Temperature			
Laws of Thermodynamics			
Simple Harmonic Motion	chp 11	2/18-2/22	[C1]
Pendulum			
Spring			
Waves	chp 12, 22, 24	2/25-3/7	[C4]
Speed, Wavelength, Frequency, Amplitude			
Sound and Light			
Doppler Shift			
Standing Waves			
Electromagnetic Spectrum			
Optics	chp 23	3/10-3/14	[C4]
Reflection, Refraction, Diffraction			
Mirrors & Lenses			
Ray Diagrams			
Quantum & Nuclear	chp 27 – chp 32	3/17-3/21	[C5]
Photons & Photoelectric Effect			
Electron Energy Levels			
Compton Scattering			
Wave Nature of matter			
Radioactive Decay			
Mass and Energy effects			
Review		4/7-5/9	
POST AP TEST:			
Special Theory of Relativity	chp 26	5/19-5/23	
Astrophysics & Cosmology	chp 33	5/26-5/30	
Standard Model of Physics		6/2-6/6	
Final Exam Week		6/9-6/13	

Labs [C6, C7]

Students will be required to keep a lab notebook (the teacher will provide you a quadrille notebook for this purpose). In addition to the lab notebook, each lab will require a typed lab report to be submitted. Your semester lab grade will be based on both the lab notebook and on the submitted lab reports. The majority of the labs are open-ended. Students are responsible for designing procedures, materials (sometimes a specific list will be given to students and sometimes students will develop the list), and to organize data in tables and graphs and do higher order thinking analysis.

The time that is listed is only the in class time which will largely be used for data collection. It is expected that the outside time will be equal to or greater than the in class time in order to do pre-lab preparations, analyze the data, and write the lab report.

Labs Semester 1:

1. *Merrily We Roll Along* [two 56 min periods] – We will extend this classic lab from Paul Hewitt in order for students to analyze acceleration and angular dependency. In particular we will discuss error analysis within this lab.
2. *The Coffee Filter and Air Resistance* [two 56 min periods] - AP Physics Lab Guide (Lab #2) – Students will develop and carry out a method to determine the mathematical relationship for a velocity-dependent force. Using graphical analysis students will then interpret their data and determine a value for the exponent from $F_{\text{drag}} = bv^n$
3. *1-D collision bull's eye lab* [two 56 min periods] – Using a given set of materials students must develop a method to determine where to place a 1 cm radius target so that a marble will hit the target on the first try. Once students develop their procedure, the directions will be exchanged with another group to follow. The key focus of this lab is for students to learn to write clear lab procedures for the lab based question on the AP exam.
4. *2-D Elastic Collisions* [two 56 min periods] – AP Physics Lab Guide (Lab #3) Students will develop a procedure to test if the collision between two marbles in two dimensions is elastic and if not how close it is.
5. *Conservation of momentum with dynamics carts* (totally inelastic, and $p_i = 0$) [three 56 min periods] – Using dynamics carts, students will design a method to determine if momentum is conserved in a totally inelastic collision as well as when the initial momentum is zero.
6. *Ohm's law* [two 56 min periods] – Students will vary voltage, resistance, and current in order to develop a relationship between the three.
7. *Parallel and Series circuits* (resistors, capacitors, batteries) [two 56 min periods] – Students will design an experiment to determine how resistors are connected in series and parallel. They will then consider how adding capacitors affects this.
8. *Plotting magnetic fields* (magnets and slinky) [two 56 min periods] – students will use compasses to measure the magnetic field direction of a variety of magnets. They will also use a magnetic field sensor to measure the strength of the magnetic field of a slinky (source: Vernier *Physics With Computers*)

Labs Semester 2 [C6, C7]

9. *Pendulum lab* [three 56 min periods] – We will introduce standard deviation in order to determine which variables are most likely to determine the period of a simple pendulum.
10. *Determining spring constant* using Hooke's Law, and Simple Harmonic Motion with a spring [two 56 min periods] – We will measure the spring constant of single springs using both Hooke's Law and Simple Harmonic Motion. Students will also attempt to determine how spring constants add in series and in parallel.
11. *Rotational motion lab* [two 56 min periods] – We will analyze the relationship between hanging masses and a rotating object in order to study centripetal force.
12. *Mechanical Equivalent of heat* [two 56 min periods] – Groups will design an experiment in order to explore the mechanical equivalent of heat. Students will first develop their own list of materials (other than thermometers they will have to supply their own materials) and procedures.
13. *Speed of sound, speed of light using a microwave* [three 56 min periods] – groups will explore the relation between wave speed, wavelength, and frequency. Using pvc and tuning forks groups will develop and test the speed of sound. They will then create a second method to test the speed of sound which they will exchange with another group. Students will then use a microwave and marshmallows to recreate this classic (see the *Physics Teacher* article for example)
14. *Optics* [two 56 min periods] – students will explore ways lenses and mirrors create real/virtual, upright/inverted, and reduced/magnified images in single and double systems.
15. *Diffraction grating and spacing on a CD/DVD* [two 56 min periods] – groups will develop a method to take a laser with an unknown wavelength and use it to determine the track spacing on a CD and on a DVD.
16. *Determining Planck's constant w/LED's* [two 56 min periods] – (Lab designed by Center for Nanoscale Systems Institute for Physics Teachers) Groups of students use a variety of super bright LED's and a handheld spectrometer in order to determine Planck's Constant.

Team Projects [C6, C7]

These projects are conducted entirely outside of class time. Students work in teams of 2-4 students in order to build something to solve a problem. Teams will need to conduct research in order to better understand how best to achieve the goal. A write-up will be expected with each project.

- Bridge [1ST SEMESTER] – Teams will design a bridge to span 20 cm using only toothpicks and glue.
- Roller Coaster [1ST SEMESTER] – Teams will design a roller coaster to study conservation of energy, potential energy, and energy transfer.
- Build your own instrument [2ND SEMESTER] – Teams will design their own instrument that is capable of playing a minimum of 10 notes and they must play a song that is recognizable.

- Learn to fly [2ND SEMESTER] – Teams will research and design an airplane that that will be judged on a combination of three criteria; 1) distance; 2) time of flight; 3) mass. Students should incorporate ideas of aerodynamics, Bernoulli's Principles, etc.
- Design-Free-For-All [2ND SEMESTER] – students will choose a topic that they would like to teach/reteach to the class using an interesting and (hopefully) innovative presentation that does not involve fire or danger.

Work will be given a due date and it is expected to be turned in on time. If a student is absent, a one-day grace period will be given to make up work for every day the student is absent. Students who are absent on lab or test days will need to make up this work within one week of their return.