	Curricular Requirements	**Pages**
CR1	Students and teachers have access to college-level resources including college-level textbooks and reference materials in print or electronic format.	2
CR2a	CR2a— The course design provides opportunities for students to develop understanding of the foundational principles of kinematics in the context of the big ideas that organize the curriculum framework.	3
CR2b	CR2b— The course design provides opportunities for students to develop understanding of the foundational principles of dynamics in the context of the big ideas that organize the curriculum framework.	3
CR2c	CR2c— The course design provides opportunities for students to develop understanding of the foundational principles of gravitation and circular motion in the context of the big ideas that organize the curriculum framework.	3
CR2d	CR2d— The course design provides opportunities for students to develop understanding of the foundational principles of simple harmonic motion in the context of the big ideas that organize the curriculum framework.	3
CR2e	CR2e— The course design provides opportunities for students to develop understanding of the foundational principles of linear momentum in the context of the big ideas that organize the curriculum framework.	3
CR2f	CR2f— The course design provides opportunities for students to develop understanding of the foundational principle of energy in the context of the big ideas that organize the curriculum framework.	3
CR2g	CR2g— The course design provides opportunities for students to develop understanding of the foundational principles of rotational motion in the context of the big ideas that organize the curriculum framework.	3
CR2h	CR2h— The course design provides opportunities for students to develop understanding of the foundational principles of electrostatics in the context of the big ideas that organize the curriculum framework.	3
CR2i	CR2i— The course design provides opportunities for students to develop understanding of the foundational principles of electric circuits in the context of the big ideas that organize the curriculum framework.	3
CR2j	CR2j— The course design provides opportunities for students to develop understanding of the foundational principles of mechanical waves in the context of the big ideas that organize the curriculum framework.	3
CR3	CR3— Students have opportunities to apply AP Physics 1 learning objectives connecting across enduring understandings as described in the curriculum framework. These opportunities must occur in addition to those within laboratory investigations	8
CR4	CR4— The course provides students with opportunities to apply their knowledge of physics principles to real world questions or scenarios (including societal issues or technological innovations) to help them become scientifically literate citizens.	7, 8
CR5	CR5— Students are provided with the opportunity to spend a minimum of 25 percent of instructional time engaging in hands-on laboratory work with an emphasis on inquiry-based investigations.	7
CR6a	CR6a— The laboratory work used throughout the course includes investigations that support the foundational AP Physics 1 principles.	4, 5, 6
CR6b	CR6b—The laboratory work used throughout the course includes guided-inquiry	4, 5, 6

	laboratory investigations allowing students to apply all seven science practices.	
CR7	CR7— The course provides opportunities for students to develop their communication skills by recording evidence of their research of literature or scientific investigations through verbal, written, and graphic presentations.	7
CR8	CR8— The course provides opportunities for students to develop written and oral scientific argumentation skills.	7

Course Introduction

AP®Physics 1 is an algebra-based course in general physics that meets for 55 minutes each day for the entire school year. General physics topics presented during the course closely follow those outlined by the College Board and also mirrors an introductory level university physics course.

AP®Physics 1 is organized around six big ideas that bring together the fundamental science principles and theories of general physics. These big ideas are intended to encourage students to think about physics concepts as interconnected pieces of a puzzle. The solution to the puzzle is how the real world around them actually works. The students will participate in inquiry-based explorations of these topics to gain a more conceptual understanding of these physics concepts. Students will spend less of their time in traditional formula-based learning and more of their effort will be directed to developing critical thinking and reasoning skills.

Textbook

Wilson, Buffa. College Physics. 5th edition.

Upper Saddle River, NJ: Pearson Education INC., 2003. [CR1]

CR1— Students and teachers have access to college-level resources including college-level textbooks and reference materials in print or electronic format

Big Ideas for AP®Physics 1

Big Idea 1: Objects and systems have properties such as mass and charge. Systems may have internal structure.

Big Idea 2: Fields existing in space can be used to explain interactions.

Big Idea 3: The interactions of an object with other objects can be described by forces.

Big Idea 4: Interactions between systems can result in changes in those systems.

Big Idea 5: Changes that occur as a result of interactions are constrained by conservation laws.

Big Idea 6: Waves can transfer energy and momentum from one location to another without the permanent transfer of mass and serve as a mathematical model for the description of other phenomena.

The big ideas for AP®Physics 1 are correlated to the content of the course and to the lab and inquiry-based investigations done throughout the school year in the following table.

Physics Principles	BI1	BI2	BI3	BI4	BI5	BI6
Kinematics [CR2a]						
Chap 1: Measurement and Problem Solving		X				
Chap 2: One Dimensional Kinematics			X	X		
Chap 3: Motion in Two Dimensions/Projectile Motion			X	X		
Dynamics of Force and Motion [CR2b]						
Chap 4: Force and Motion (Newton's Laws)	X	X	X	X		
Chap 7: Circular Motion & Gravitation	X	X	X	X		
Chap 8: Rotational Motion & Equilibrium	X	X	X	X		
Universal Law of Gravitation [CR2c]						
Chap 7: Circular Motion & Gravitation	X	X	X	X		
Simple Pendulum and Mass-Spring Systems [CR2d]						
Chap 13: Vibrations and Waves			X		X	
Impulse, Linear Momentum, & Conservation of Linear Momentum [CR2e]						
Chap 6: Linear Momentum and Collisions			X	X	X	
Work, Power, Energy, and Conservation of Energy [CR2f]						
Chap 5: Work and Energy			X	X	X	
Rotational Kinematics and Conservation of Angular Momentum [CR2g]						
Chap 8: Rotational Motion and Equilibrium			X	X	X	
Electrostatics [CR2h]						
Chap 15: Electric Charge, Force, and Fields	X		X		X	
Simple DC Circuits [CR2i]						
Chap 17: Electric Current & Resistance	X				X	
Chap 18: Basic Electric Circuits	X				X	
Waves and Sound [CR2j]						
Chap 13: Vibrations and Waves						X
Chap 14: Sound						X

CR2a— The course design provides opportunities for students to develop understanding of the foundational principles of kinematics in the context of the big ideas that organize the curriculum framework.

CR2b— The course design provides opportunities for students to develop understanding of the foundational principles of dynamics in the context of the big ideas that organize the curriculum framework.

CR2c— The course design provides opportunities for students to develop understanding of the foundational principles of gravitation and circular motion in the context of the big ideas that organize the curriculum framework.

CR2d— The course design provides opportunities for students to develop understanding of the foundational principles of simple harmonic motion in the context of the big ideas that organize the curriculum framework.

CR2e— The course design provides opportunities for students to develop understanding of the foundational principles of linear momentum in the context of the big ideas that organize the curriculum framework.

CR2f— The course design provides opportunities for students to develop understanding of the foundational principle of energy in the context of the big ideas that organize the curriculum framework.

CR2g— The course design provides opportunities for students to develop understanding of the foundational principles of rotational motion in the context of the big ideas that organize the curriculum framework.

CR2h— The course design provides opportunities for students to develop understanding of the foundational principles of electrostatics in the context of the big ideas that organize the curriculum framework.

CR2i— The course design provides opportunities for students to develop understanding of the foundational principles of electric circuits in the context of the big ideas that organize the curriculum framework.

CR2j— The course design provides opportunities for students to develop understanding of the foundational principles of mechanical waves in the context of the big ideas that organize the curriculum framework.

Kinematics						
1. Velocity and Acceleration Lab: Students use a ticker-tape machine to investigate velocity and acceleration of a small cart. Lesson 1a (L1a) Guided Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			X			
2. Creating Motion: Students use a motion detector in order to recreate different types of motion into graphs. Students use objects rolling down inclined planes to create acceleration graphs. (L1b) Guided Inquiry Investigation SP 1.1, 1.2, 1.4, 2.1, 3.1, 4.1, 4.2, 4.3, 5.1, 6.1, 6.2		X	X			
3. Vector Addition Simulation: Using an online simulation, students investigate how velocity vectors add and subtract. (L2) Guided Inquiry Investigation SP 1.2, 1.4, 3.3, 4.3, 4.4, 5.1, 5.2, 5.3, 6.1, 6.2, 6.4				X		
4. Projectile Investigation: Students will use the kinematic equations of motion to determine the landing location of a ball launched horizontally off a table. (L3) Open Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.3, 5.1, 6.1			X			
5. Projectile Motion Lab: Students will launch a water balloon at an angle of 45 degrees in order to hit a specific target. (Lab 1) Open Inquiry Investigation SP 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.2, 4.3, 5.1, 5.2, 6.1, 6.2, 6.3, 6.4, 6.5, 7.2		X	X	X		
Dynamics of Forces and Motion						
6. Kick Disk Inquiry: Students use a kick disk (hover puck) to investigate how applied forces influence motion. (L4) SP 1.1, 1.2, 3.1, 3.3, 4.2, 5.1, 6.1	X		X	X		
7. Equilibrium: Students use low friction carts to investigate stationary equilibrium and when in constant motion. (L4) SP 1.1, 1.2, 3.1, 3.3, 4.2, 5.1, 6.1	X	X	X	X		
8. Force and Acceleration: Students use force probes and motion detectors in order to understand the relationship between force and acceleration. This includes accelerations produced on inclined planes. (L5) Guided Inquiry Investigation SP 1.4, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, 4.3, 5.1, 6.1, 6.2	X		X	X		
9. Newton's 3rd Law Exploration: Students use bathroom scales in order to investigate Newton's 3rd Law through different scenarios. (L6) Guided Inquiry Investigation SP 1.2, 1.5, 3.1, 5.1, 6.1, 6.2, 6.5	X		X	X		
10. Equilibrium and Static Friction Lab: Students use Newton's 2nd Law in order to determine the mass of a	X	X	X	X		

cup of marbles suspended in equilibrium by 2 strings at different angles. Next, students determine the coefficient of static friction of a book cover and a quarter. (Lab 2) Open Inquiry Investigation SP 1.5, 2.1, 2.2, 3.3, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2						
Universal Law of Gravitation						
11. Galileo Ramps: Students use different inclined planes to determine the gravitational acceleration constant on Earth. (L7) SP 1.1, 1.4, 2.1, 2.2, 3.2, 4.1, 5.1, 5.2, 6.2, 7.2	X	X	X	X		
12. Kepler's Law: Students determine Kepler's Law by analyzing actual data. (L7) Inquiry Investigation SP 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 6.2, 6.3, 7.2	X	X	X			
Simple Pendulum and Mass-Spring Systems						
13. Hooke's Law: Students determine the relationship between distance stretched and force. (L8) SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2, 7.2			X		X	
14. Pendulum Properties: Students determine what factors affect the period of a pendulum and the period of a mass-spring system. (L8) Guided Inquiry Investigation SP 1.1, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2			X		X	
Impulse, Momentum, and Conservation of Linear Momentum						
15. Impulse Exploration: Students use a falling mass connected to a cart to determine the carts change in momentum. (L9a) SP 1.1, 1.2, 1.4, 3.1, 4.1, 4.1, 5.1, 6.1		X	X	X	X	
16. Momentum and Collisions: Students use a computer applet in order to determine how momentum is transferred and conserved through different collisions. (L9b) SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			X	X	X	
17. Egg Drop Lab: Students use what they know about impulse and momentum to design and build an egg drop package that will be dropped from 5 meters. (Lab 3) Open Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.1, 3.3, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2			X	X	X	
Work, Power, Energy, and Conservation of Energy						
18. Energy to Work Exploration: Students use a falling mass connected to a low friction cart to determine how gravitational potential energy is converted to kinetic energy. (L10a) Guided Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2		X	X	X	X	
19. Energy to Work Part 2: Students use a cart that is attached to a spring to investigate how elastic potential energy is converted to kinetic energy. (L10b) Guided Inquiry Investigation			X	X	X	

SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2						
Rotational Kinematics and Conservation of Angular Momentum						
20. Torque Lab: Students determine factors that affect the rotational motion of an object. (L11a) SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			X	X	X	
21. Rolling Cylinders: Students determine how the type of cylinder rolled affects the time of roll. Students will investigate rotational dynamics and energy of each rolling cylinder. (L11a) SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			X	X	X	
22. Centripetal Force Lab: Students use a spinning washer with different hanging masses in order to determine centripetal force. (L12 and Lab 4) Guided Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2		X	X	X	X	
23. Conservation of Angular Momentum Lab: Students will drop an object with known moment of inertia onto a rotating turntable. Conservation of Angular Momentum in this collision. (L11b) Guided Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			X	X	X	
Electrostatics						
24. Static Charge: Students use tape with similar and different charges in order to determine charge interactions. Students will then use this basic understanding of charge to investigate conservation of charge. (L13a) Guided Inquiry Investigation SP 1.1, 1.2, 1.4, 3.1, 4.1, 5.1, 6.1	X	X	X	X	X	
25. Coulomb's Law: Students determine the relationship between force, charge, and distance between charges. (L13b) Guided Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2	X		X		X	
Simple DC Circuits						
26. Electric Circuits Lab: Students determine voltage and current relationships in simple circuit orientations (series and parallel). Students will use Ohm's Law and Kirchoff's Law while investigating these circuits. (L14 and Lab 5) Open-Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2	X				X	
Waves and Sound						
27. Springs Lab: Students use two different long springs to investigate spring amplitude, tension, and material are related. They also use the springs to investigate interference of waves. (L15a) Inquiry Investigation SP 1.1, 1.2, 1.4, 3.1, 4.1, 4.1, 5.1, 6.1						X

28. Resonance: Students use PVC pipes, buckets of water, and tuning forks in order to find resonance of sound. (L15b) Guided-Inquiry Investigation SP 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2						X
29. Standing Waves and Beats: Students determine how beats and standing waves are produced. (L15b) SP 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2						X

CR6a— The laboratory work used throughout the course includes investigations that support the foundational AP Physics 1 principles.

CR6b—The laboratory work used throughout the course includes guided-inquiry laboratory investigations allowing students to apply all seven science practices.

Additional Course Information

Labs & Classwork

Labs are all "hands-on" and placed throughout the instructional year. Students will spend at least 25% of class time in laboratory investigations. [CR5] Labs can be either teacher directed or student directed/open-ended. During a teacher-directed lab ,the students are given instruction on the operation of lab equipment and guidance in the process of the experiment. Student-directed labs are when the students are given an objective, e.g. "Determine the acceleration due to gravity on Earth," and standard materials needed to conduct a lab. Students are allowed to create their own experimental design and collect data, which can be analyzed through graphical methods. These inquiry-based investigations or student-directed labs have an extra element added to the lab report. After these labs, each student group must present their results to the class and defend their results. They will also evaluate one other group's approach to the problem and offer a critique of their procedures and results. Once each lab group has been critiques by their peers, they will write a response to the critique. In this response, they must either make changes to their original work as suggested by their peers, or defend their original work directly responding to their peers' critique. [CR8]

CR5— Students are provided with the opportunity to spend a minimum of 25 percent of instructional time engaging in hands-on laboratory work with an emphasis on inquiry-based investigations.

CR8— The course provides opportunities for students to develop written and oral scientific argumentation skills.

Students work in lab groups, but each student must submit a lab report which is turned in the day after the conclusion of each activity, then graded and returned. The report must include the following components: [CR7]

- Statement of the problem
- Hypothesis
- Discussion or outline of how the procedure will be carried out
- Data collected from the experiment
- Data analysis
- Conclusion including error analysis
- Peer review and response (if included in this lab)

CR7— The course provides opportunities for students to develop their communication skills by recording evidence of their research of literature or scientific investigations through verbal, written, and graphic presentations.

Students are required to keep the reports in an organized lab notebook. This lab notebook will kept by the students for the entire year and must include the completed lab reports as well as the raw data tables and any notes made during the execution of the labs done in the course. [CR7]

Two lab investigations during the year are extended projects that require using data collected by outside sources. Students will utilize this data to find out answers to questions posed by the instructor and also questions they formulate themselves.

Real World Activity:

Car Crash Physics: This past year a lawyer approached me with a problem. His client was hurt in a crash, but the insurance company was claiming there was not enough force generated in the crash to cause injuries. The students will be given the same problem and asked to come up with an answer to the insurance company. They will research information needed and write a report detailing their conclusions. Each group will present their findings to the class and also review and critique another group's conclusions and methods used to come up with their answer. As one group presents their findings as experts, the other group will be acting as the insurance company trying to find holes in their argument. [CR4]

Kepler Telescope Exoplanet Discovery: The Kepler telescope has been discovering evidence about new planets around other stars for the last few years. Some of this data is posted on the Internet and we will use it to determine properties of these planets. Students will have a new planet to investigate and determine as many physical properties about that planet as possible form the data set. The investigation requires the students to utilize Learning Objectives 2.B.2.1, 3.A.2.1, 3.A.4.2, 3.B.2.1, 3.C.1.2, and 4.A.1.1. [CR3]

CR4— The course provides students with opportunities to apply their knowledge of physics principles to real world questions or scenarios (including societal issues or technological innovations) to help them become scientifically literate citizens.	CR3— Students have opportunities to apply AP Physics 1 learning objectives connecting across enduring understandings as described in the curriculum framework. These opportunities must occur in addition to those within laboratory investigations.