DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

AP PHYSICS 1 SYLLABUS

Course Introduction

AP® Physics 1 is an algebra-based course in general physics that meets for 45 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.

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.

Outline of course correlation to AP© Physics 1 Principles, Course Requirements (CR), and Big Ideas (BI):

CR1: Students and teachers have access to college-level resources including college-level textbooks and reference materials in print or electronic format.
Giancoli, Douglas C.. *Physics Principles with Applications*. 5th edition. Upper Saddle River, NJ: Prentice Hall, 1998.

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.

Physics Principle: Kinematics	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
Chap 1: Introduction to Physics		✓				

Chap 2: Describing Motion; Kinematics in One Dimension			✓	✓		
Chap 3: Kinematics in Two Dimensions; Vectors			✓	✓		

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.

Physics Principle: Dynamics	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
Chap 4: Motion and Force; Dynamics	✓	✓	✓	✓		
Chap 5: Circular Motion; Gravitation	✓	✓	✓	✓		

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.

Physics Principle: Gravitation and Circular Motion	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
Chap 4: Motion and Force; Dynamics	✓	✓	✓	✓		
Chap 5: Circular Motion; Gravitation	✓	✓	✓	✓		

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.

Physics Principle: Simple Harmonic Motion	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
Chap 4: Motion and Force; Dynamics			✓	✓	✓	
Chap 11: Vibrations and Waves			✓		✓	

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.

Physics Principle: Linear Momentum	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
Chap 6: Work and Energy			✓	✓	✓	
Chap 7: Linear Momentum			✓	✓	✓	

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.

Physics Principle: Energy	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
Chap 4: Motion and Force; Dynamics			✓	✓	✓	
Chap 6: Work and Energy			✓	✓	✓	

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.

Physics Principle: Rotational Motion	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
Chap 8: Rotational Motion			✓	✓	✓	

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.

Physics Principle: Mechanical Waves	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Chap 11: Vibrations and Waves						✓
Chap 12: Sound						✓

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.

Physics Principle: Electrostatics	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Chap 16: Electric Charge and Electric Field	✓		✓		✓	
Chap 17: Electric Potential and Electric Energy; Capacitance	✓					

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.

Physics Principle: Electric Circuits	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Chap 18: Electric Currents	✓				✓	
Chap 19: DC Circuits	✓				✓	

For additional time remaining after the AP© Test, the course design provides opportunities for students to develop understanding of the foundational principles of statics or fluid dynamics, depending on student preference.

Physics Principle: Statics and Fluids	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Chap 9: Bodies in Equilibrium; Elasticity and Fracture	✓		✓	✓	✓	
Chap 10: Fluids	✓		✓	✓	✓	

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.

Physics Principle and AP© Science Practices (SP): Kinematics	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
1. Car Velocity Lab: students determine the velocity and acceleration of a toy car. 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			✓			
2. Reaction Time: students figure out a method to determine their reaction time. *Guided-Inquiry Investigation* 1.4, 2.1, 2.2, 3.1, 4.2, 5.1, 6.1, 6.2, 7.2			✓			
3. Projectile Motion 1: students determine the landing location of a ball launched horizontally from a table. 1.1, 1.4, 2.1, 2.2, 3.3, 5.1, 6.1			✓			
4. Projectile Motion 2: students have to shoot a ball through a hoop placed at a particular location when launched at an angle.			✓			

1.1, 1.4, 2.1, 2.2, 3.3, 5.1, 6.1						

Physics Principle and AP© Science Practices (SP): Dynamics of Force and Motion	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
5. Force Table and Vectors: students determine missing forces to produce translational equilibrium. 1.4,2.1,2.2, 3.3, 5.1, 5.2, 6.2	✓	✓	✓	✓		
6. Atwood's Machine: students determine the formula for the acceleration of a simple Atwood's machine. 1.4, 2.1, 2.2, 3.3, 5.1, 5.2, 6.2	✓	✓	✓	✓		
7. Inclined Planes Forces and Friction: students determine what effect an incline has on the value of friction and determine coefficients of friction for various objects. *Guided-Inquiry Investigation* 1.4, 2.1, 2.2, 3.1, 4.2, 5.1, 5.2, 6.1, 7.2	✓	✓	✓	✓		

Physics Principle and AP© Science Practices (SP): Universal Law of Gravitation	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
8. Galileo Ramps: students use ramps at different angles to determine what happens to the acceleration. 1.1, 1.4, 2.1, 2.2, 3.2, 4.1, 5.1, 5.2, 6.2, 7.2	✓	✓	✓			
9. Kepler Exoplanet Data: students determine Kepler's laws by analyzing actual data. *Inquiry Investigation* 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 6.2, 6.3, 7.2	✓	✓	✓			

Physics Principle and AP© Science Practices (SP): Simple Pendulum and Mass-Spring Systems	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
10. Hooke's Law: students determine the relationship between distance stretched and force. 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2, 7.2			✓		✓	
11. Pendulum Properties: students determine what factors affect the period of a pendulum *Guided-Inquiry Investigation* 1.1, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2			✓		✓	

Physics Principle and AP© Science Practices (SP): Impulse, Momentum, and Conservation of Momentum	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
12. Momentum and Collisions: students determine momentum before and after in different types of collisions. 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			✓	✓	✓	

13. Car Crash Physics: students design a car that will safely protect an egg in a crash. *Open-Inquiry Investigation* 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			✓	✓	✓	

Physics Principle and AP© Science Practices (SP): Work, Energy, and Conservation of Energy	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
14. Ballistics Pendulum: students determine the initial speed of a "bullet." *Guided-Inquiry Investigation* 1.1, 1.4, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2			✓	✓	✓	
15. Energy to Work Lab: students determine how work changes energy. 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			✓	✓	✓	

Physics Principle and AP© Science Practices (SP): Rotational Kinematics and Conservation of Angular Momentum	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
16. Torque Lab: students determine factors that affect the rotational motion of an object. 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			✓	✓	✓	
17. Rolling Cylinders: students determine how the type of cylinder rolled affects time of roll. 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2			✓	✓	✓	
18. Flying Pigs and Centripetal Force: students determine the factors that affect centripetal force. *Guided-Inquiry Investigation* 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2			✓	✓	✓	

Physics Principle and AP© Science Practices (SP): Electrostatics	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
19. Coulomb's Law: students determine the relationship between force, charge and distance between charges. *Guided-Inquiry Investigation* 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2	✓		✓		✓	

Physics Principle and AP© Science Practices (SP): Simple DC Circuits	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
20. Electric Circuit Lab: students determine voltage and current relationships in simple circuit orientations (series and parallel). *Open-Inquiry Investigation*	✓				✓	

1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2						

Physics Principle and AP© Science Practices (SP): Waves and Sound	**BI 1**	**BI 2**	**BI 3**	**BI 4**	**BI 5**	**BI 6**
21. Resonance Apparatus Lab: students determine the speed of sound by using resonance in a tube. *Guided-Inquiry Investigation* 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1, 6.2, 7.2						✓
22. Beats and Standing Waves: students determine how beats and standing waves are produced. 1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 5.1, 6.2						✓

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. **[CR8]**

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 (if included in this lab)

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]**