AP Physics 1 Syllabus (2017-2018)
Paulding County High School

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Course Description: 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.

Grading Policy: (Subject to change based county policy)

A (90-100) B (80-89) C (70-79) F (below 70) 60% summative, 20% formative, 20% final exam

Flipped Classroom Model: This "flipped" course will utilize a variety of podcasts to introduce students to new concepts. Students are not expected to fully "understand" the concepts covered in podcasts. Podcasts are their first exposure to the rote background information and basic terminology. Students will then practice, apply, and explore these concepts in the classroom. The flipped classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed. Short video lectures, or podcasts, are viewed by students at home before the class session. This way, in-class time is devoted to laboratories, projects, discussions, and addressing student questions over the content. If viewing this syllabus online (CLICK HERE) for a thorough explanation of the flipped classroom model.

Class/Lab Procedures and Rules: Students must return their signed Flinn Safety contracts before participating in lab-based activities. All school policies in the student handbook will be followed, as well as all lab safety rules and teacher policies. Tardy policy will be followed as listed in the student handbook.

Performance Assessments will include, but will not be limited to quizzes, unit tests, lab reports, projects, podcast composition book, and final exams.

Required Materials: Students must have a glued-stitched graph composition notebook for their labs, a glued-stitched college-ruled composition notebook for their notes, computer flash drive, and a scientific calculator

Textbook: Knight, R., Jones, B., & Field, S. *College Physics: A Strategic Approach*. 3rd edition. Pearson Education, Inc., 2015.

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.

Outline of AP® Physics 1 Principles and Correlation to Big Ideas (BI):

Physics Principles	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Kinematics [CR2a]						
Chap 1: Vectors and Mathematical Concepts		✓				
Chap 2: One Dimensional Kinematics			✓	✓		
Chap 3: Two Dimensional Motion and Projectile Motion			✓	✓		
Dynamics of Force and Motion [CR2b]						
Chap 4: Newton's Laws of Motion	✓	✓	✓	✓		
Chap 5: Circular Motion, Rotation, and Gravity	✓	✓	✓	✓		
Universal Law of Gravitation [CR2c]						
Chap 4: Newton's Laws of Motion	✓	✓	✓	✓		
Chap 5: Circular Motion, Rotation, and Gravity	✓	✓	✓	✓		
Simple Pendulum and Mass-Spring Systems [CR2d]						
Chap 4: Newton's Laws of Motion			✓	✓	✓	
Chap 10: Oscillations & Simple Harmonic Motion			✓		✓	
Impulse, Linear Momentum,and Conservation of Linear Momentum [CR2e]						
Chap 7: Impulse, Momentum, and Collisions			✓	✓	✓	
Work, Energy, and Conservation of Energy [CR2f]						
Chap 6: Work, Energy, and Power			✓	✓	✓	
Rotational Kinematics and Conservation of Angular Momentum [CR2g]						
Chap 8: Rotational Kinematics & Rotational Energy			✓	✓	✓	
Chap 9: Torque & Rotational Dynamics			✓	✓	✓	
Electrostatics [CR2h]						
Chap 18: Conservation of Electric Charge, Electric Forces & Fields	✓		✓		✓	
Chap 19: Electrostatics; Conductors, Capacitors	✓					
Simple DC Circuits [CR2i]						
Chap 20: Electric circuits, Ohm's law, Kirchhoff's laws	✓				✓	
Waves and Sound						
Chap 16: Mechanical Waves and Sound **[CR2j]**						✓
Chap 17: The Principle of Linear Superposition and Interference Phenomena						✓

AP Test Review for the time remaining until the AP Test.

Time after AP Test will be spent on Relativity, Astronomy, and other topics.

Outline of AP® Physics 1 Labs and investigations with Correlation to Big Ideas (BI):

Physics Principles and AP® Science Practices [CR6a] [CR6b]	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Kinematics						
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			✓			
Dynamics of Force and Motion						
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	✓	✓	✓	✓		
Universal Law of Gravitation						
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 Principles and AP® Science Practices [CR6a] [CR6b]	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Simple Pendulum and Mass-Spring Systems						
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			✓		✓	
Impulse, Momentum, and Conservation of Momentum						
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			✓	✓	✓	
Work, Energy, and Conservation of Energy						
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			✓	✓	✓	
Rotational Kinematics and Conservation of Angular Momentum						
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 Principles and AP® Science Practices [CR6a] [CR6b]	BI 1	BI 2	BI 3	BI 4	BI 5	BI 6
Electrostatics						
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	✓		✓		✓	
Simple DC Circuits						
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	✓				✓	
Waves and Sound						
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						✓

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. 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. 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.