SAMPLE SYLLABUS #1

AP® Physics 1

Curricular Requirements

CR1	Students and teachers have access to college-level resources including a college-level textbook and reference materials in print or electronic format.	*See page:* 2
CR2	The course provides opportunities to develop student understanding of the required content and related big ideas outlined in each of the units described in the AP Course and Exam Description (CED).	*See page:* 3
CR3	The course provides opportunities for students to develop the skills related to Science Practice 1: Modeling.	*See page:* 9
CR4	The course provides opportunities for students to develop the skills related to Science Practice 2: Mathematical Routines.	*See page:* 10
CR5	The course provides opportunities for students to develop the skills related to Science Practice 3: Scientific Questioning.	*See page:* 8
CR6	The course provides opportunities for students to develop the skills related to Science Practice 4: Experimental Methods.	*See page:* 9
CR7	The course provides opportunities for students to develop the skills related to Science Practice 5: Data Analysis.	*See page:* 10
CR8	The course provides opportunities for students to develop the skills related to Science Practice 6: Argumentation.	*See page:* 9
CR9	The course provides opportunities for students to develop the skills related to Science Practice 7: Making Connections.	*See page:* 10
CR10	The course provides students with opportunities to apply their knowledge of AP Physics concepts to real-world questions or scenarios to help them become scientifically literate citizens.	*See page:* 11
CR11	Students spend a minimum of 25 percent of instructional time engaged in a wide range of hands-on laboratory investigations with an emphasis on inquiry-based labs to support the learning of required content and development of science practice skills throughout the course.	*See page:* 8
CR12	The course provides opportunities for students to record evidence of their scientific investigations in a portfolio of lab reports or a lab notebook (print or digital format).	*See page:* 11

Advanced Placement Physics 1 Sample Syllabus #1

Texts: Serway and Faughn. *College Physics.*, 6th ed. Philadelphia: Thomson, Brooks Cole, 2003 **CR1**

AP Physics 1 Student Workbook, College Board. 2019.

CR1
The teacher must provide the title, author, and publication date of an algebra-based, college-level textbook on their course audit form.

Course Outline

The AP® Physics 1 course meets every day, three days a week for 50 minutes and two days a week for 100 minutes. Each student receives two credits for the completion of the course. It is a stand-alone course. The course is an inquiry-based course that focuses on experimentation and also conceptual understanding. Lessons that are teacher oriented will include the derivation of equations, demonstrations of physical phenomena, vocabulary associated with the content, and addressing any questions from the students based upon the material covered. The content of this course is based upon 6 big ideas:

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 charges 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 discretion of other phenomena.

Student Practice

Throughout each unit, **Topic Questions** will be provided to help students check their understanding. The Topic Questions are especially useful for confirming understanding of difficult or foundational topics before moving on to new content or skills that build upon prior topics. Topic Questions can be assigned before, during, or after a lesson, and as in-class work or homework. Students will get rationales for each **Topic Question** that will help them understand why an answer is correct or incorrect, and their results will reveal misunderstandings to help them target the content and skills needed for additional practice.

At the end of each unit or at key points within a unit, **Personal Progress Checks** will be provided in class or as homework assignments in AP Classroom. Students will get a personal report with feedback on every topic, skill, and question that they can use to chart their progress, and their results will come with rationales that explain every question's answer. One to two class periods are set aside to re-teach skills based on the results of the Personal Progress Checks.

Course Content CR2

Unit	Topics	Content	Science Practice	Big Idea
1 Kinematics	1.1 Position, Velocity and Acceleration	▪ Vector Measurements of displacement and velocity ▪ Vector addition and subtraction ▪ Systems of directional designations ▪ Acceleration and related quantities ▪ Relative Velocity	1.5 2.1 2.2 4.2 5.1	3, 4
	1.2 Representations of Motion	▪ Gravitational Acceleration ▪ Vector Addition Using Pythagorean theorem, law of sines and cosine law ▪ Projectile motion	1.2 1.4 2.2 2.3 6.4	
Complete **Personal Progress Check MCQ** for Unit 1. Complete **Personal Progress Check FRQ** for Unit 1. Take **Unit 1 Test.**				
2 Dynamics	2.1 Systems		1.1 7.1	1, 2, 3, 4
	2.2 The Gravitational Field	▪ Weight ▪ Gravitational field strength	2.2 7.2	
	2.3 Contact Forces	▪ Normal Force ▪ Tension ▪ Friction ▪ Spring Force	6.1 6.2	
	2.4 Newton's First Law	▪ Inertial mass vs. Gravitational Mass ▪ Newton's First Law	4.2	
	2.5 Newton's Third Law and Free Body Diagrams	▪ Free Body Diagrams ▪ Newton's Third Law	1.1 1.4 6.1 6.2 6.4 7.2	
	2.6 Newton's Second Law	▪ Newton's Second Law	1.1 1.4 1.5 2.2 4.2 5.1 6.4 7.2	
Complete **Personal Progress Check MCQ A** for Unit 2.				

CR2
The syllabus must include an outline of course content by unit title or topic using any organizational approach to demonstrate the inclusion of required course content and associated big ideas listed in the AP Physics 1 Course and Exam Description (CED).

Unit	Topics	Content	Science Practice	Big Idea
	2.7 Applications of Newton's Second Law	▪ Applications of Newton's Second Law including friction in uniform and accelerated conditions, both at angled and horizontal and vertical surfaces	1.2 1.4 2.2 2.3 5.3 6.4	
Complete **Personal Progress Check MCQ B** for Unit 2. Complete **Personal Progress Check FRQ** for Unit 2. Take **Unit 2 Test**.				
3 Circular Motion and Gravitation	3.1 Vector Fields		N/A	1, 2, 3, 4
	3.2 Fundamental Forces	▪ Gravitational Force ▪ Electromagnetic force ▪ Weak and Strong forces	7.1	
	3.3 Gravitational and Electric Forces	▪ Newton's Universal Law of Gravitation ▪ Connection between Gravitational Force and Electric Force	2.2 7.2	
	3.4 Gravitational Field/ Acceleration Due to Gravity on Different Planets	▪ Weight on different planets	2.2 7.2	
	3.5 Inertial vs. Gravitational Mass	▪ Inertial vs. Gravitational Mass	4.2	
	3.6 Centripetal Acceleration and Centripetal Force	▪ Centripetal Acceleration	5.3	
	3.7 Free Body Diagrams for Objects in Uniform Circular Motion	▪ Analysis of objects in uniform circular motion including conical pendulums.	1.1 1.4 1.5 2.2 4.2 5.1	
	Complete **Personal Progress Check MCQ A** for Unit 3.			
	3.8 Applications of Circular Motion and Gravitation	▪ Orbital Circular Motion ▪ Applications of Circular Motion and Gravitation	1.1 1.4 1.5 2.1 2.2 4.2 5.1 6.2 6.4 7.2	

Unit	Topics	Content	Science Practice	Big Idea
Complete **Personal Progress Check MCQ B** for Unit 3. Complete **Personal Progress Check FRQ** for Unit 3. Take **Unit 3 Test**.				
4 Energy	4.1 Open and Closed Systems: Energy	▪ Defining Systems ▪ Conserved vs. Constant	6.4 7.2	3, 4, 5
	4.2 Work and Mechanical Energy	▪ Work ▪ Kinetic Energy ▪ Work/Energy Theorem ▪ Potential Energy	1.4 2.1 2.2 6.4 7.2	
	4.3 Conservation of Energy, the Work-Energy Principle, and Power	▪ Conservation of Mechanical Energy ▪ Power	1.4 1.5 2.1 2.2 4.2 5.1 6.4 7.2	
Complete **Personal Progress Check MCQ A** for Unit 4. Complete **Personal Progress Check MCQ B** for Unit 4. Complete **Personal Progress Check FRQ** for Unit 4. Take **Unit 4 Test**.				

Unit	Topics	Content	Science Practice	Big Idea
5 Momentum	5.1 Momentum and Impulse	▪ Center of Mass ▪ Momentum ▪ Change in Momentum ▪ Impulse	2.1 4.1 4.2 5.1 6.4	3, 4, 5
	5.2 Representations of Changes in Momentum	▪ Change in Momentum from representations ▪ Graph of net external force vs. time and change in momentum vs. time	1.4 2.2 5.1	
	5.3 Open and Closed Systems: Momentum	▪ Defining Systems ▪ Conserved vs. Constant	6.4 7.2	
	5.4 Conservation of Linear Momentum	▪ Center of Mass motion during collisions/explosions ▪ Elastic & Inelastic Collisions ▪ Using Conservation of Momentum and Energy to make predictions	2.1 2.2 3.2 4.1 4.2 4.4 5.1 5.3 6.4 7.2	
Complete **Personal Progress Check MCQ A** for Unit 5. Complete **Personal Progress Check MCQ B** for Unit 5. Complete **Personal Progress Check FRQ** for Unit 5. Take **Unit 5 Test**.				
6 Simple Harmonic Motion	6.1 Period of Simple Harmonic Oscillators	▪ Hooke's Law ▪ Simple Harmonic Motion ▪ Pendulums ▪ Mass-Spring Systems	2.2 4.2 5.1 6.2 6.4 7.2	3, 5
	6.2 Energy of Simple Harmonic Oscillators	▪ Energy Analysis of Simple Harmonic Oscillators	1.4 2.1 2.2 6.4 7.2	
Complete **Personal Progress Check MCQ** for Unit 6. Complete **Personal Progress Check FRQ** for Unit 6. Take **Unit 6 Test**.				

Unit	Topics	Content	Science Practice	Big Idea
7 Torque and Rotational Motion	7.1 Rotational Kinematics	▪ Rotational Kinematics	1.5 2.1 2.2	3, 4, 5
	7.2 Torque and Angular Acceleration	▪ Definition of Torque ▪ Force Diagrams ▪ Rotational Inertia ▪ Static Equilibrium ▪ Rotational Dynamics ▪ Rotational Impulse	1.4 2.1 2.2 2.3 4.1 4.2 5.1 5.3 6.4 7.2	
	7.3 Angular Momentum and Torque	▪ Angular Momentum ▪ Rotational Kinetic Energy	1.2 1.4 2.2 3.2 4.1 4.2 5.1 5.3	
	7.4 Conservation of Angular Momentum	▪ Conservation of Angular Momentum ▪ Collisions involving objects free to rotate and/or translate.	2.1 2.2 6.4 7.2	
Complete **Personal Progress Check MCQ A** for Unit 7. Complete **Personal Progress Check MCQ B** for Unit 7. Complete **Personal Progress Check FRQ** for Unit 7. Take **Unit 7 Test**.				

Labs

Laboratory investigations will occupy 25-50% of our class time, usually filling at least one entire double block. In the laboratory investigations students, will learn and master the usage of physical and scientific equipment. Students will use different methods of measuring, charting, calculating, and error analysis while completing the investigations. These investigations can be used to either introduce a new topic or to reinforce material previously covered. All investigations are typically guided, with the variables needed to be measured and calculated identified for the students. Of the labs performed, more than half are guided - and open-inquiry based. Below is a table of Lab Investigations: **CR11**

	Name	Description	Science Practices
Unit 1: Kinematics	Runner Lab	Reproduce motion graphs using computer software	1.1, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2
	Incline Plane Lab [G.I.]	Graphically determine the acceleration of an object on an inclined plane	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
	Gravitational Constant Lab [G.I.]	Graphically compare the acceleration of objects that are undergoing freefall	1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2
	2d Motion Lab #1	Determine the initial velocity of an object being launched horizontally from a table	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
	2d Motion Lab #2 [G.I.]	Determine the initial velocity and angle of a projectile, and predict where the object will land	1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
Unit 2: Dynamics	Tension Lab	Determine the tension in three different strings that are attached to a hanging mass	1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2
	Newton's 2nd Law Lab [O.I.]	Determine the relationship between the acceleration of a cart, its mass and the net force applied to the cart **CR5**	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.4, 7.2
	Atwood Machine Lab	Determine the acceleration of objects and the tension in the string for an Atwood Machine	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
	Angle of Repose Lab	Determine the angle of repose for multiple surface combinations	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
	Friction Lab [O.I.]	Using computer software compare coefficients of static and kinetic friction for different surface combinations using multiple methods	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2

CR11

The syllabus must include an explicit statement that at least 25 percent of instructional time is spent engaged in hands-on laboratory investigations, with an emphasis on inquiry-based labs.

AND

Laboratory investigations must be listed with a title and brief description. Guided- and open-inquiry labs must be labeled.

CR5

The syllabus must include one assignment, activity, or lab describing how students engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course. The assignment, activity, or lab must be labeled with the relevant practice(s) associated with Science Practice 3.

As long as one practice under Science Practice 3 is represented, evidence is sufficient.

	Name	Description	Science Practices
Unit 3: Circular Motion and Gravitation	Whirligig Lab [O.I.]	Determine the tension in the string on an object that undergoing centripetal acceleration. Compare theoretical and experimental periods	1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
	Moon Lab	Graphically determine the mass of Jupiter by researching the planet's moons	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4, 7.1
Unit 4: Energy	Rollercoaster Lab	Find the mechanical energy lost by a ball going around a rollercoaster by using forces, energy, and 2D motion	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
	Conservation Lab	Determine if the mechanical energy of a dropped object is constant using video analysis	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
	Energy Lost Due to Friction Lab	Determine the mechanical energy dissipated by a non-conserved force exerted on an object accelerating on a table CR3 CR8	1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 6.5, 7.2
Unit 5: Momentum	Collisions Lab	Investigate conservation of momentum in different types of collisions	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
	Impulse Lab [G.I.]	Graphically compare the impulse of an object hitting a force sensor in momentum experienced by the object	1.1, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2
Unit 6: Simple Harmonic Motion	Spring constant lab [G.I.]	Use multiple methods to determine the spring constant of a spring and compare the results CR6	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
	Pendulum Lab [O.I.]	Determine what factors influence the period of a pendulum	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
	Oscillating Spring Lab [G.I.]	Determine what factors influence the period of an oscillating spring	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
	Energy in Springs Lab	Investigate conservation of energy for an oscillating spring	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4, 7.2

CR3

The syllabus must include one assignment, activity, or lab describing how students use representations and models to communicate scientific phenomena and solve scientific problems. The assignment, activity, or lab must be labeled with the relevant practice(s) (e.g., "1.2") associated with Science Practice 1.

As long as one practice under Science Practice 1 is represented, evidence is sufficient.

CR8

The syllabus must include one assignment, activity, or lab describing how students work with scientific explanations and theories. The assignment, activity, or lab must be labeled with the relevant practice(s) associated with Science Practice 6.

As long as one practice under Science Practice 6 is represented, evidence is sufficient.

CR6

The syllabus must include one assignment, activity, or lab describing how students plan and implement data collection strategies in relation to a particular scientific question. The assignment, activity, or lab must be labeled with the relevant practice(s) associated with Science Practice 4.

As long as one practice under Science Practice 4 is represented, evidence is sufficient.

	Name	Description	Science Practices
Unit 7: Torque and Rotational Motion	Equilibrium Lab [O.I.]	Build an apparatus and that is equilibrium when placed on a pivot point CR7 CR9	1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.4, 7.1, 7.2
	Torque Lab	Determine the relationship between torque and the angular acceleration of the system	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4, 7.2
	Moment of Inertia Lab [G.I.]	Determine what factors affect an object's rotational inertia	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
	Rotational Energy Lab	Using computer software, explore if mechanical energy is constant as object rolls down an incline	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
	Angular Momentum Lab	Compare the experimental and theoretical results of the conservation of angular momentum	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
	Building Circuits Lab	Compare the theoretical and experimental results of equivalent resistances for complex circuits CR4	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4

CR7

The syllabus must include one assignment, activity, or lab describing how students perform data analysis and evaluation of evidence. The assignment, activity, or lab must be labeled with the relevant practice(s) associated with Science Practice 5.

As long as one practice under Science Practice 5 is represented, evidence is sufficient.

CR9

The syllabus must include one assignment, activity, or lab describing how students connect and relate knowledge across various scales, concepts, and representations in and across domains. The assignment, activity, or lab must be labeled with the relevant practice(s) associated with Science Practice 4.

As long as one practice under Science Practice 7 is represented, evidence is sufficient.

CR4

The syllabus must include one assignment, activity, or lab describing how students use mathematics appropriately. The assignment, activity, or lab must be labeled with the relevant practice(s) associated with Science Practice 2.

As long as one practice under Science Practice 2 is represented, evidence is sufficient.

In these laboratory investigations students, will work in groups, but each student is responsible for completing their own work and paper lab report. Each lab report will consist of:

- Title
- Purpose: What is the purpose of the lab? What are we trying to find?
- Design: A diagram of the lab setup, list of equipment, and description of procedure
- Data: All data that is collected in the lab.
- Data Analysis: Any calculations done in the lab, including graphs
- Error Analysis: Sources of error and their effect on results
- Conclusion: A statement that describes the purpose and essence of the investigation.

All lab reports will be collected in a final lab portfolio (hardcopy or electronic). **CR12**

CR12
The syllabus must include the components of the written reports required of students for all laboratory investigations.

AND

The syllabus must include an explicit statement that students are required to maintain a lab notebook or portfolio (hard copy or electronic) that includes all their lab reports.

Pens with Friends

One of the most important skills for success in AP Physics 1 is argumentation. During each unit, students will participate in two rounds of "Pens with Friends". "Pens with Friends" consists of two parts: "Friends without Pens" and "Pens without Friends". The first part, students are paired up randomly and given a problem that pertains to the current unit. Students will have a set amount of time to discuss the problem, without writing anything down. This will help students develop oral scientific argumentation skills. The second part, "Pens without Friends", students will work on the same problem, independently without discussing it with anyone else. This will help students develop writing scientific argumentation skills. When both parts are complete, students will then grade a random classmates written portion in hopes to help the student understand the AP grading process.

Final Project

After the AP Exam in May, students will work on their final projects. Students will have three different options to choose from. The first option is students can work in groups to perform a video analysis on a physical phenomenon using logger pro. The video analysis must include content from a minimum of 3 of the units listed above. The second option is students can independently complete a research project on how the laws of physics can be applied to situations in the real world. The paper must contain content from a minimum of 5 of the units listed above. Lastly students can choose a current real-life issue or scenario that is affecting society and discuss how physics impacts the issue. This must contain content from a minimum of 2 of the units listed above. There will be more information given about the final project after the AP exam. **CR10**

CR10
The syllabus must label and provide a description of at least one assignment or activity requiring students to apply their knowledge of AP Physics concepts to understand real-world questions or scenarios.

Grading

In terms of grading, there are approximately 3 quizzes per quarter, two quarter exams, Pens with Friends, and also homework and laboratory assignments. The quarter grades are split approximately 5% homework, 5% Pens with Friends, 10% Labs, 40% quizzes, and 40% quarter tests