



# Hendrickson High School

Pflugerville Independent School District

## ADVANCED PLACEMENT PHYSICS 1, 2014-2015

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**Classroom:** B-214

**Class website:** [masteringphysics.com](http://masteringphysics.com)

### OVERVIEW

This class is designed to be taught as a college level class in a high school setting; as such, we will be modeling a college class as much as possible throughout the year. The goal of this class is to prepare students to take the AP Physics 1 exam on Wednesday, May 6, 2015 (12pm) and get college credit for the class. There are eleven units based on the newly redesigned AP Physics 1 course description. A test constructed from past AP papers concludes every unit.

This is the first of two Algebra-based AP Physics courses and will continually emphasize the following 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 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 course will be further broken down in two eleven units with the following approximate test dates:

Unit	Length of unit (weeks)	Approximate test date
<b>1: Kinematics</b> - 1 dimensional kinematics with constant acceleration, and projectile motion, vector addition, graphical, verbal, mathematical representations of motion (Big Idea 3)	5	A: 9/25 B: 9/26
<b>2: Dynamics</b> - Systems, Newton's laws, friction and drag, torque and rotational statics (Big Ideas 1, 2, 3, and 4)	4	A: 10/21 B: 10/22
<b>3: Circular motion</b> - uniform circular motion (Big Ideas 1, 2, 3, and 4)	2	A: 11/4 B: 11/5
<b>4: Work, Energy, and Conservation of Energy</b> - Conservation of energy, work, power, oscillating systems (dynamics and energy relationships) (Big Ideas 3, 4, and 5)	3	A: 11/20 B: 11/21
<b>5: Momentum</b> - Impulse, conservation of linear momentum, collisions (1-d, 2-d) (Big Ideas 3, 4, and 5)	2	A: 12/11 B: 12/12
<b>6: Simple harmonic motion</b> - simple pendulums, mass-spring oscillators	2	A: 1/15 B: 1/16
<b>7: Rotational motion and torque</b> - rotational kinematics, rotational energy,	4.5	A: 2/18

torque and rotational dynamics, angular momentum, conservation of angular momentum (Big Ideas 3, 4, and 5)		B: 2/19
<b>8: Universal Law of Gravitation</b> - universal gravitation, and orbits (Big Ideas 1, 2, 3, and 4)	1	A: 2/26 B: 2/27
<b>9: Mechanical waves and sound</b> - Wave pulses, traveling waves, standing waves on a string and in an open or closed pipe, reflection, refraction, interference, and diffraction	2	A: 3/11 B: 3/12
<b>10: DC circuits</b> - Conductors, current, resistance, power, Ohm's law, circuits	1.5	A: 3/31 B: 4/1
<b>11: Electrostatics</b> - Charge, field, potential, Coulomb's law, capacitors, conductors	1.5	A: 4/9 B: 4/10
<b>AP Test review and practice</b>	1	5/6
<b>Projects</b>	4	6/2

### Homework, quizzes and other work:

Homework is an integral part of this course as it allows for more practice of the work we will be doing in class. Homework problems are assigned from the text, the University of Texas Homework Service, and past AP papers. The course is designed to encourage students to apply concepts to the problems, rather than algorithms. Daily homework directly addresses concepts discussed in class. Example problems are not always worked in class in advance of the homework assignment. All students are expected to attempt all problems and a few students are chosen to present their solutions to the class on whiteboards or other device. The class discusses whether the approach is reasonable, whether the correct model has been applied, and if the calculations are correct. The goal is to make all students think analytically about the nature of the problem, including the content and the solution process.

There are frequent quizzes, many designed to assess whether students understand the concepts in the homework from the night before. This provides a reason to not procrastinate in completing the online homework, and encourages students to be concerned with understanding the problems, rather than just completing the assignment.

We will be drawing from several textbooks this semester:

Main text: College Physics, by Knight, Jones and Field

Other texts: Physics, by Cutnell and Johnson

Physics, by Giancoli (this is the text used by most universities)

College Physics by Urone et al., available free for students at

<https://openstaxcollege.org/textbooks/college-physics>

### LABS

Forty percent of class time will be lab work. Many units begin with a laboratory investigation preceding any other instruction. The subject of the lab is designed to introduce one or more concepts important in the unit. These labs begin with a demonstration for the students to discuss. In the discussion they are prompted to brainstorm variables that might be reasonably presumed to

govern the behavior of the apparatus. They then design and conduct an investigation to find relationships between the variables. A class discussion follows in which the class describes a model for the behavior observed. Afterwards the model becomes explanatory, and can be invoked in explaining concepts and solving problems.

Some labs are presented as open-ended lab problems. For example, in the Kinematics unit, students are given graphs or descriptions of motion and must manipulate a set of materials to reproduce the graph or description with a motion detector or video analysis.

All labs require written work. Students are required to keep a binder or notebook with all of their completed, graded labs in it. Some labs consist of a challenging lab problem and don't lend themselves to a traditional lab report. For these, students submit a narrative (with sketches and calculations, where appropriate) of their attempts to solve the problem, and an analysis of their success.

Class time for labs is allotted only for pre-lab discussion, data collection, and class discussion of results. Students who fail to complete data collection during class must make arrangements to complete it during lunch, a free block, or break. Students must complete data analysis, answers to questions, and report writing outside of class. Lab reports are considered test grades and should be treated with the same seriousness as an exam.

Students are expected to keep a lab notebook where they will maintain a record of their laboratory work. Lab reports will consist of the following components:

- Title
- Objective/Problem
- Design (if applicable): If the lab has no set procedure, what is to be done? Why are you doing it this way?
- Data: All data gathered in the lab will go here
- Calculations/Graphs: Calculations are done here. Any graphs that need to be made go here.
- Conclusion: Data analysis occurs here, and a statement can be made about what was learned in the lab. Error analysis also occurs here. Evaluation of the lab occurs here as well.

**LABS (details subject to change based on material available)**

<b>Name</b>	<b>Open- Inquiry or Guided- Inquiry?</b>	<b>Short Description</b>	<b>Science Practices</b>
#1 Speed Lab	Y	Students will design an experiment to determine the range of speeds of a variable speed cart.	2.1, 2.2, 4.1, 4.2, 4.3
Three Cars Racing Simulation	N	A computer simulation of three cars with different accelerations racing.	1.4, 2.2, 4.3, 6.1
#2 Rocket Lab	Y	Students will design an experiment to determine the initial velocity of an air-powered rocket.	1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 4.3

#3 Marble in Cup Lab	N	Students will determine where a paper cup needs to be placed on the floor so that a marble rolled off of the edge of a table will land in it.	1.4,2.1,2.2, 2.3, 4.3
#4 Projectile Motion Challenges	Y	Using a projectile launcher, students will be given a series of challenges such as placing a ring stand at the maximum height, or placing a cup at the point where the marble will land.	1.4,2.1,2.2, 4.1,4.2,4.3
#5 Newton's 2nd Law Lab	Y	What is the relationship between the mass of a system and the 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
Forces on a Crate Simulation	N	Using a simulation, analyze the motion of a crate. Students can vary the force on the crate, the direction of that force, the initial velocity of the crate, and the coefficient of kinetic friction.	1.1,1.4,2.2, 4.3, 6.1
Jupiter's Moons	N	Students will do research on Jupiter and four of its moons. Based on this research, students will mathematically come up with the mass of Jupiter. They will compare this information to the accepted value.	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
#6 Introductory Circular Motion Lab	Y	When velocity is kept constant, what is the relationship between the radius of circular motion and the period of circular motion? The speed? The acceleration?	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 Centripetal Force Lab	Y	Using a spinning rubber stopper to lift masses, students will determine the relationship between the acceleration of the stopper and the centripetal force.	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
#8 Conservation of Linear Momentum Lab	Y	Using a track and collision carts, students will observe seven different collisions and make conclusions about momentum conservation in real life situations.	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
A Two Car Collision Simulation	N	Students will observe a simulation of two identical cars crashing. The elasticity of the collision can be varied.	1.1,1.4,2.2, 4.3, 6.1
#9 Pendulum Lab	Y	What factor(s) control the period of a simple 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

#10 Mass-Spring Oscillator Lab	Y	Students must determine both the spring constant $k$ of a spring and the mass of three unknown masses. Students must also investigate the conservation of mechanical energy of the system. Materials given: spring with unknown spring constant, known masses, unknown masses.	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
#11 Conservation of Angular Momentum Lab	Y	What is the relationship between the moment of inertia of a system and the angular momentum of a 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
Torque Simulation	N	Students will use a computer simulation to study rotational equilibrium.	1.1,1.4,2.2, 4.3,6.1
#12 Coulomb's Law Lab	Y	What is the charge stored on a pair of charged balloons that are repelling each other?	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
#13 Series and Parallel Lab	Y	Using a number of resistors, explore current and voltage in resistors hooked up to a power supply when resistors are wired in series with one another and when they are wired in parallel with one another	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
Electrostatics Simulation	N	Using a computer simulation involving two positive charges, explore the electrostatic force of repulsion between the charges, the accelerations of the charges, and how the force and acceleration changes with distance.	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
#14 Standing Waves on a Wire Lab	Y	Students will vary wavelength, frequency, and the tension in a wire while looking at standing waves formed on a wire.	1.1,1.4,2.1,2.2, 3.3,4.1,4.2, 4.3,4.4,5.1, 6.1,6.2,
#15 Standing Sound Waves in a Tube Lab	N	Students will vary the frequency of sound coming out of a speaker to create standing waves in a tube to determine the speed of sound in the classroom.	1.1,1.4,2.1,2.2, 3.3,4.1,4.4, 5.1,6.1,6.2,6.4

### Real-world Physics

In each unit, we will have at least one major question that relates to real-world experiences that students must research and analyze. These include collision statistics and car safety systems, movie examples, technology such as wireless charging and noise-cancelling headphones, and amusement park rides. Students will write up their findings as well as prepare a presentation for the class to be presented on our Physics TED-Ed club days.

**Make-up work policy:**

1. *The student is responsible for all make-up work.*
2. The student will schedule time before or after school to complete make-up work.
3. Make -up work is expected with-in 2 days, following your return to class, unless other arrangements are made with the teacher’s approval.
4. Students should turn in all assignments due on the day they were absent, the next day they return to class.
5. **Students are not exempt from a test or an assignment because they were absent.**

**Redo/Retest Policy** 1. Students may retest or redo any major assignment if their grade is below a 70%.

2. The retest will be different from the original test & a 70 is the maximum a student can score.
3. Before the student takes the retest they should:
  - ✓ Correct original test.
  - ✓ Come to tutorials for reteaching.
  - ✓ Complete all assignments that have not turned in or finished.
  - ✓ Schedule the Retest during tutorials with in 5 days of the original test.
4. **Most labs, quizzes, & assignments scoring less than a 70% can be improved for a better grade.**

**Late Work Policy** All students will be afforded the opportunity to submit late work.

- ✓ Late work is defined as work that was assigned to the student and was not completed by the due date and the student does not have a good reason for it being postponed. (If student has a good reason the due date will be extended.)
- ✓ The teacher will determine the worthiness of the late assignment submitted. The assignment should be complete.
- ✓ Late work submitted will receive a grade that is no higher than a 70 if the work is complete.
- ✓ Late work must be submitted by the end of the **3-week grading period.**

**Grading:**

<b>Major (Summative) Grades 4 or more per grading period</b>	<b>Minor (Formative) Grades 10 or more per grading period</b>
Category Weight <b>80%</b>	Category Weight <b>20%</b>
<ul style="list-style-type: none"><li>• Tests/Exams</li><li>• Combined Quizzes</li><li>• Projects</li><li>• Performances</li><li>• Products</li><li>• Major Labs</li><li>• Presentations</li></ul>	<ul style="list-style-type: none"><li>• Independent practice</li><li>• Quizzes</li><li>• Warm-ups</li><li>• Reviews</li><li>• Journals</li><li>• Components of Writing Process</li><li>• Lab Experience</li><li>• Daily work</li></ul>