AP Physics 1
Fall 2016 – Spring 2017
Course Syllabus

Course Overview: AP Physics 1 is an algebra-based, introductory college-level physics course that explores topics such as Newtonian mechanics (including rotational motion); work, energy, and power; mechanical waves and sound; and introductory, simple circuits. Through inquiry-based learning, students will develop scientific critical thinking and reasoning skills. (http://media.collegeboard.com/digitalServices/pdf/ap/ap_physics1_2page_course_overview.pdf)

Instructor: *Constance June & Rhys Kadekawa*

Textbook: Giancoli, Douglas. *Physics, Principles and Applications, 6th Ed.* Pearson, 2005

Material Expectations:

Composition Notebook	Pencils	Scissors
Notebook Paper	Colored Pens (blue, black, red, etc.)	Scotch Tape
Graphing Paper	Highlighter	Glue Stick
Graphing Calculator	Rulers	

iPad Expectations: Students are expected to bring their iPads to class everyday charged and ready to use. Assignments may be accessed and submitted through the iPad during class-time. Students without iPad access are expected to bring paper copies of these assignments to class. iPads may also be used during class-time for quizzes and labs. Games or other off task behavior during class time is not permitted

Work Habits: All writing must be legible and in blue/black ink or pencil **only**. All papers should contain a heading in the upper right corner with name, class period, and date. Papers without a name will receive a grade of zero, if not claimed within the next class period. Any assignment not designated as partner work may not be identical to any other person or book. Copied work will not receive credit. Students are responsible for reading the corresponding chapters for each unit and studying notes to be prepared for pop quizzes.

Evaluation: Students will get grades on homework, quizzes, laboratory work, projects, and exams. Exams are typically worth 100 points and will consist of questions similar to ones students will see on the AP Exam. Homework assignments and quizzes will consist of problems from the textbook, supplements, and old AP Exams. Projects are long-term, and typically will involve groups of students developing a plan, collecting data and/or research, and presenting conclusions in a meaningful way. Laboratory work is student centered and inquiry based.

Grades: Grades will be weighted according to the following categories: Tests/Projects 50%, Labs 30%, and Daily/Homework/Quizzes 20%. This grade will constitute 80% of the final grade with the Semester Final contributing 20%.

Missing and Late Assignments: As per MISD late work policy, late work will be accepted for up to three days after the due date, at a penalty of 15 points per day.

Homework: Homework will be assigned throughout the year using an online system. Students will be expected to be log in to view and complete their assignments. Most assignments will be long, but due dates will generally be given a week in advance, so students are encouraged to get started early and not put the homework off until the last minute. If logging in at home is an issue, students will be able to log in at school to access their assignments and submit their answers.

Quizzes: Quizzes may be assigned with or without notice and may not be corrected or retaken. Some quizzes may be taken electronically, so students should bring their iPads (or other devices) charged and ready to use.

Labs and Lab Safety: A safety contract must be signed by a guardian and turned in before ANY labs are performed. Failure to turn in this form will result in a zero for a lab and may result in removal from the class as labs are required by the College Board. Students are expected to be responsible during lab time; any horseplay or hazardous behavior will result in immediate removal from the lab and disciplinary action.

Tests: All tests will consist of multiple choice, free response, and writing prompt sections. Tests may range from one to two days of class time and will be graded based upon AP grading standards. Students will learn and practice AP grading standards on classmates' tests, but the grade will always be given by the instructor and never a fellow student. Note: A system will be in place to ensure confidentiality.

Test Corrections: Prior to each test, all students may be given an extra credit assignment that will count towards their grade on the associated test, to a maximum test score of 100. Students who fail with a grade below 70% will be given a make-up opportunity as designated by their teacher; make-up test grades will be scored at a maximum of 70%. Students who fail their make-up test assignment will not be given another chance.

Academic Dishonesty: Per district policy, a student found to have engaged in academic dishonesty shall be subject to grade penalties on assignments or tests and disciplinary penalties in accordance with the Student Code of Conduct. Academic dishonesty includes cheating or copying the work of another student, plagiarism, and unauthorized communication between students during an examination. The determination that a student has engaged in academic dishonesty shall be based on the judgment of the classroom teacher or another supervising professional employee, taking into consideration written materials, observation, or information from students.

About This Course: The AP Physics 1 course will meet for 90 minutes every other school day. Lab work is integral to the understanding of the concepts in this course. The AP Physics 1 course has been designed by the College Board as a course equivalent to an algebra-based college-level physics class. At the end of the course, students will take the AP Physics 1 Exam, which will test their knowledge of both the concepts taught in the classroom and their use of the correct formulas.

The content for the course is based on six 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.

Topics Covered:

1. Kinematics (Big Idea 3)
   a. Vectors/Scalars
   b. One Dimensional Motion (including graphing position, velocity, and acceleration)
   c. Two Dimensional Motion

2. Dynamics (Big Ideas 1, 2, 3, and 4)
   a. Newton's Laws of Motion and Forces

3. Universal Law of Gravitation (Big Ideas 1, 2, 3, and 4)
   a. Circular Motion

4. Simple Harmonic Motion (Big Ideas 3 and 5)
   a. Simple Pendulums
   b. Mass-Spring Oscillators

5. Momentum (Big Ideas 3, 4, and 5)
   a. Impulse and Momentum
   b. The Law of Conservation of Momentum

6. Energy (Big Ideas 3, 4, and 5)
   a. Work
   b. Energy
   c. Conservation of Energy
   d. Power

7. Rotation (Big Ideas 3, 4, and 5)
   a. Rotational Kinematics
   b. Rotational Energy
   c. Torque and Rotational Dynamics
   d. Angular Momentum
   e. Conservation of Angular Momentum

8. Electrostatics (Big Ideas 1, 3, and 5)
   a. Electric Charge
   b. The Law of Conservation of Electric Charge
   c. Electrostatic Forces

9. Circuits (Big Ideas 1 and 5)
   a. Ohm's Law
   b. Kirchhoff's Laws
   c. Simple DC Circuits

10. Mechanical Waves and Sound (Big Idea 6)

Laboratory Activities: Twenty five percent of the course will be lab work. [CR5] Labs may take several in-class days to finish, and students may have to do work outside of class as well. 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 and evaluation also occur here.

Every major unit will have an inquiry-based lab, and inquiry-based labs will make up no less than half of the laboratory work. Collectively, laboratory work will engage students in all seven science practices.

NAME	DESCRIPTION	SCIENCE PRACTICES
Speed Lab Open Inquiry	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
Students In a Foot Race	The class will analyze the motion of two students in a 40m foot race.	1.4, 2.2, 4.3, 6.1
Rocket Lab Guided Inquiry	Students will design an experiment to determine the maximum velocity of a liquid-air, or solid fuel rocket.	1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 4.3
Hit the Target Lab Guided Inquiry	Students will determine where to place a bull's eye on the floor so that a ball bearing rolled off of a raised inclined plane will hit it.	1.4, 2.1, 2.2, 2.3, 4.3
Newton's Second Law Lab Guided Inquiry	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 Rider Open Inquiry	Students will use force gauges and accelerometers to analyze the forces on a student riding a skateboard	1.1, 1.4, 2.2, 4.3, 6.1
Jupiter's Moons	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
Pendulum Lab Open Inquiry	What factors 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
Mass-Spring Oscillator Lab Open Inquiry	Students must determine the spring constant k of multiple springs	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
Conservation of Linear Momentum Guided Inquiry	Using a track and collision carts, students will observe different collisions and make conclusions about momentum conservation	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
Circular Motion Lab Guided Inquiry	With constant speed, students will determine the relationship between the radius and period of circular motion.	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
Centripetal Force Lab Guided Inquiry	Students will determine the relationship between the acceleration of a spinning rubber stopper and the force necessary to hold it at a certain radius.	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
Conservation of Angular Momentum Lab Guided Inquiry	Students will determine the relationship of the moment of inertia 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 and Rotation Lab Open Inquiry	Students will learn about torque through use of an in class made balance system and random office supplies.	1.1, 1.4, 2.2, 4.3, 6.1
Coulomb's Law Lab Guided Inquiry	Students will attempt to find the charge on two objects 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
Series and Parallel Circuits Lab Guided Inquiry	Students will be introduced to current and voltage by assembling a range of series and parallel circuits. They will also be individually tested in order to show proficiency in assembling a circuit based on a random circuit diagram.	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
Harmonics Lab Open Inquiry	Students will examine the relationship between frequency and wavelength by using a frequency generator app on a cell phone and finding the points where it resonates within an open tube.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.4, 5.1, 6.1, 6.2, 6.4
Standing Waves Lab Open Inquiry	Students will vary the wavelength, frequency, and tension in a coil of wire while attempting to form standing waves.	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

In addition to labs, students will be required to do several projects throughout the year to apply their learning of physics concepts. Examples of potential projects are given below. A more detailed rubric for each project will be presented when the project is assigned.

Projectile Launcher
Students will construct their own projectile launcher with a minimum range of 10 meters. Students will ultimately have to hit a 2 x 2 ft target laid flat on the ground but must also apply video analysis to the motion of their projectile in order to produce graphs of position, velocity, and acceleration vs time. (LO 3.A.1.1, 3.A.1.2, 3.A.1.3, 4.A.2.1,)

Mousetrap Car
Students will construct a small vehicle that maximizes the potential energy of a mousetrap to the kinetic energy of the vehicle while also minimizing the force of friction for maximum displacement. Students will then graph the position of their vehicle over time and attempt to find the maximum acceleration provided by their mousetrap as well as the force of friction working against their car. (LO 1.C.1.1, 3.A.1.1, 3.A.1.2, 3.A.1.3, 3.D.1.1, 3.D.2.2, 3.E.1.4, 4.A.2.1,)

Electric House
Students will construct and wire a small doll house with DC series and parallel wiring. Circuit components include a power supply, switches, low voltage lightbulbs, electric motors, and noisemakers. Other components not listed may be utilized in addition to the main list but all designs must be checked with the instructor. Students will provide circuit schematics of their houses and use multimeters to obtain accurate circuit component values. (LO 5.B.9.3, 5.C.3.1, 5.C.3.3)

Rube Goldberg Machine
Students will construct a series of chain reactions that demonstrate multiple types of energy transfers. Each group will provide a working project binder that describes group roles, a calendar of events, project costs, and energy transfer details. (LO 3.A.3.1, 3.A.4.1, 3.A.4.2, 3.B.2.1, 5.A.2.1, 5.B.3.1, 5.D.1.1,)

Hawaiian Falls Waterpark
Students will analyze different rides at a waterpark and apply concepts from sections such as energy conservation, rotational motion, waves, momentum, and forces.

Real World Physics Solutions:
In order for students to become scientifically literate citizens, students are required to use their knowledge of physics while looking at a real world problem. Students may pick one of the following problems:

- Students will analyze a video game attempting to depict physics in the real world. They will then attempt to determine if the depiction is accurate and present their results to the class.
- Students will pick a Hollywood movie and will point out three (or more) instances of bad physics. They will present this information to the class, describing the inaccuracies both qualitatively and quantitatively.
- Students will research a thrill ride at an amusement park. They will present information to the class on the safety features of the ride, and why they are in place.
- Students will go to the insurance institute of highway safety website (iihs.org) and will look at the safest cars in a crash. They will present information as to why these cars are safer and how the safety features keep people safe.