COURSE INTRODUCTION

The AP Physics 1 course is designed to be the equivalent of a first-semester, algebra-based, college-level physics course. This class will explore such topics as Newtonian mechanics (including rotational motion); work, energy, and power; mechanical waves and sound; and introductory simple electrical circuits. Lab work is integral to the full understanding of the concepts in this course. Through inquiry-based learning, students will develop scientific critical thinking and reasoning skills. 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.

STRUCTURE OF THE COURSE

This course is structured around the six big ideas articulated in the AP Physics 1 curriculum framework provided by the College Board. Special emphasis will be placed on the seven science practices, which capture important aspects of the work that scientists engage in, with learning objectives that combine content knowledge with inquiry and reasoning skills.

The big ideas are:

- **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 of other phenomena.

The science practices for AP Physics 1 are designed to get students to think and act like scientists. The science practices are:

- **Science Practice 1:** The student can use representations and models to communicate scientific phenomena and solve scientific problems.
- **Science Practice 2:** The student can use mathematics appropriately.
- **Science Practice 3:** The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
- **Science Practice 4:** The student can plan and implement data collection strategies in relation to a particular scientific question.
- **Science Practice 5:** The student can perform data analysis and evaluation of evidence.
- **Science Practice 6:** The student can work with scientific explanations and theories.
- **Science Practice 7:** The student can connect and relate knowledge across various scales, concepts, and representations in and across domains.

The course will be taught in a manner very similar to that in which universities teach physics. Typically, two days per week will be lecture, two will be recitation, and one will be a lab day. The recitation days are devoted to applying the concepts learned in lecture. That can mean:

class discussion, physics problem-solving practice, mini labs or other activities to further illustrate the points made in lecture, the reading of physics books or journal articles, etc.

TEXTBOOKS AND OTHER TEACHING MATERIALS

Primary Textbook

Lyublinskaya, I. et al, *College Physics for AP Courses*. Houston: OpenStax, 2017. **[CR1]**

Additional Teaching Resources

Day, C. (Ed.), *Cracking the AP Physics 1 Exam*, New York: Princeton Review, 2018.

Etkina, E., Gentile, M. & Van Heuvelen, A. *College Physics: AP Edition*. Boston: Pearson, 2014 **[CR1]**

Fogiel, M. (Ed.). *The Physics Problem Solver*. Piscataway, NJ: Research and Education Association (REA), 1998.

Knight, R. *Physics for Scientists and Engineers: A Strategic Approach.* 4th edition. Boston, MA: Pearson Education, Inc., 2017. **[CR1]**

Horton, Michael. *Take-Home Physics*. Arlington, VA: NSTA Press, 2009.

Mancino, J. & Vick, V. *Fast Track to a 5: Preparing for the AP Physics 1 and AP Physics 2 Examinations*, Boston: Cengage Learning, 2018.

Rideout, K. & Wolf, J.. *AP Physics 1 and 2*. Barron's, 2013.

Wolfson, Richard. *Physics and Our Universe: How It All Works*. The Great Courses. DVD. Chantilly, VA: The Teaching Company, 2011. **[CR1]**

REQUIRED & RECOMMENDED MATERIALS

Required: notebook for lab work (Note: This should be a quadrille ruled composition book.) Alternatively, you may keep an electronic notebook and submit lab write-ups through CANVAS); notebook for taking notes and organizing handouts (I recommend a 3-ring binder with college-ruled loose-leaf paper); scientific calculator with scientific notation, trig functions, log and natural log functions, and the ability to raise to any power or take any root; pencils (including colored pencils) and erasers; protractor (I have some in the classroom, but your life will be easier if you bring your own).

Recommended: A graphing calculator will make your life easier, but is not necessary for success in this class. They can also get rather pricey. Be aware that calculator use is permitted on both sections of the AP Physics 1 exam, but calculators with QWERTY keypads and/or the ability to connect to the internet are ***not*** permitted. If you have a smart phone or tablet computer, I will be making use of various physics apps and online simulations to illustrate key concepts. An internet-ready device will help you explore these apps independently. These devices are ***not*** permitted during tests or quizzes. Recommended apps include: *Varsity Tutors AP Physics 1*, *Physics Toolbox Suite*, and *Smart Tools*. They are all free to download! If you bring your laptop

to class, you might want to download the *Tracker Video Analysis and Modeling Tool* and begin familiarizing yourself with it prior to the first day of class, as we use it quite a bit for labs. You can download it here: https://physlets.org/tracker/.

COURSE OUTLINE

1. Introduction (~1 week)
    a. Standards of Length, Mass, and Time
    b. The Building Blocks of Nature
    c. Dimensional Analysis
    d. Uncertainty in Measurement and Significant Figures
    e. Conversion of Units
    f. Estimates and Order-of-Magnitude Calculations
    g. Coordinate Systems
    h. Trigonometry
    i. Problem-Solving Strategy
2. Kinematics (2-4 weeks)
    a. Kinematics in one dimension: constant velocity and uniform accelerated motion
    b. Vectors: vector components and resultant
    c. Kinematics in two dimensions: projectile motion
3. Dynamics (6-8 weeks)
    a. Forces: types and representation
    b. Newton's First Law
    c. Newton's Second Law
    d. Newton's Third Law
    e. Applications of Newton's Laws
    f. Friction
    g. Interacting objects: ropes and pulleys
4. Circular Motion and Gravitation (~4 weeks)
    a. Uniform circular motion
    b. Dynamics of uniform circular motion
    c. Universal Law of Gravitation
5. Energy (~4 weeks)
    a. Work
    b. Power
    c. Kinetic Energy
    d. Potential energy: gravitational and elastic
    e. Conservation of energy
6. Momentum (~4 weeks)
    a. Impulse
    b. Momentum
    c. Conservation of Momentum
    d. Elastic and inelastic collisions
7. Simple Harmonic Motion and Waves (~4 weeks)
    a. Linear restoring forces and simple harmonic motion
    b. Simple harmonic motion graphs
    c. Simple pendulum

   d. Mass-spring systems
   e. Traveling waves
   f. Wave characteristics
   g. Sound
   h. Superposition
   i. Standing waves
8. Rotational Motion (~4 weeks)
   a. Torque
   b. Center of mass
   c. Rotational kinematics
   d. Rotational dynamics and rotational inertia
   e. Rotational energy
   f. Angular momentum
   g. Conservation of angular momentum
9. Electrostatics and DC Circuits (~4 weeks)
   a. Electrical charge and conservation of charge
   b. Electric Force: Coulomb's Law
   c. Electric resistance
   d. Ohm's Law
   e. DC Circuits
   f. Series and parallel circuits
   g. Kirchoff's Rules and Combination Circuits

EVALUATION

Tests & Quizzes (60% of grade)

Tests (40% of grade) will be announced at least one week in advance, and will model the AP test questions. This is intended to familiarize you with the format of the AP exam. As Louis Pasteur famously said, "Fortune favors the prepared mind." Each test will include some questions based upon previously covered material so that students do not forget earlier concepts. Quizzes (20% of grade) will consist of problems from the textbook, supplemental materials, and old AP Exams. On average, you can expect a test or quiz each week. All tests (not quizzes) may be retaken to improve the score, but retakes must be completed within one week of the day the test was first administered. Students found to be skipping class will have their score reduced by 10% (county policy) and will forfeit the privilege of a retake. If a student retakes a test, the average of the two scores will be the score recorded.

Labs (30% of grade)

Students are engaged in hands-on laboratory work, integrated throughout the course, which accounts for at least 25% of the class time. All of the laboratory experiments in this course are hands-on. Students work in groups of two or three, depending upon the lab. They collect, process, manipulate, and graph data from both qualitative and quantitative observations. Much of the laboratory work requires students to design and carry out experiments and analyze data using guided inquiry **(GI)** and open inquiry **(OI)** principles. Some laboratory activities may take several class periods to complete. For all labs, students are required to report the purpose of the experiment, the experimental procedures employed, all data collected, data analysis, error analysis, results, and conclusions in a lab report that is submitted for grading. Each student will

keep his or her laboratory work in a separate notebook, which will be collected regularly and used to assign grades for the lab exercises. Students are expected to follow lab safety rules at all times.

Classwork, Homework (10% of grade)
In this class, homework is a way of practicing the skills learned in class or for preparing for the topics that will be covered in future class periods. It is also an opportunity to practice solving the types of problems you will encounter on the AP Physics 1 Exam. I do not assign busy work: homework is designed to strengthen what has been introduced in a lesson or to help make learning a future lesson easier. While we will go over much of the homework and solve additional problems in class, it is essential that students practice problem-solving skills on their own at home. You learn physics by doing physics.

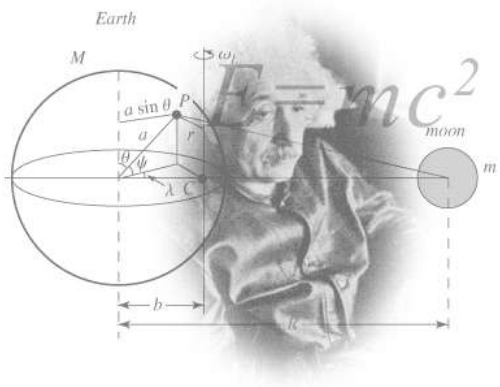
ADDITIONAL HELP
If you need help outside of class, I am available in the morning from 7:45 until 8:25 and in afternoon until at least 3:30 every day. In addition, AP Physics study guides are available for your use. Take advantage of Mitchell's Academic Lunch periods, where you can be tutored by science teachers and/or student NHS members. I can also recommend some excellent websites and physics review and problem-solving books. *Please* ask for help at the first sign of trouble – do not wait until a small difficulty has snowballed into a seemingly overwhelming obstacle to your success!

How To Succeed In Physics By Really Trying
Physics is a fascinating subject that can be a lot of fun to study. That being said, it is also a challenging course, especially for those who have little experience with rigorous quantitative science classes. You can reduce your stress level, enhance your success in this class, and actually enjoy learning physics by following a few simple guidelines:

1. **Keep up with your assignments**. Homework questions are chosen carefully in order to help you understand the concepts. You should also keep up with assignments in your math classes because you will be using those skills in Physics.
2. **Read the chapter before we cover the material in class**. This will enable you to absorb more from lectures and class activities. It will also allow you to come prepared with focused, intelligent questions about concepts that seem difficult to understand.
3. **Understand – Don't memorize.** Students often make the mistake of trying to memorize long lists of equations and definitions. This is not a productive use of your study time. Instead, strive to understand the underlying physical principles.
4. **Ask Questions.** Few people can pick up a Physics textbook and teach the subject to themselves. That's why I'm here! If you don't understand something or get stuck on a homework question or problem, ask me about it in class – I guarantee that you will not be the only student with that same question.
5. **Practice.** You learn science by doing science. If you are still shaky on a topic after reading your text and doing the assigned homework questions, do some of the unassigned questions until it begins to click.
6. **Know your learning style.** If you learn by seeing, read and re-read the text and your notes; pay careful attention to diagrams and demonstrations; seek out online physics videos (I will have many suggestions); etc. If you learn by hearing, do your reading

aloud; spend your time in lecture *listening* rather than trying to copy down everything I say; turn your notes into a song or rap; etc. If you learn by doing, pay close attention to what you're doing in lab; try your own (***safe***) experiments at home (I will give you suggestions); make your own detailed drawings/diagrams of the concepts; re-write your notes and outline the text; etc. If you learn best in a group, form a study group with classmates or friends who are also taking AP Physics 1.

7. **Make use of outside resources.** There are a number of excellent Physics study guides on the market, and I would be happy to give you several recommendations. You might also want to check out the following website: http://www.khanacademy.org/. It contains thousands of short videos explaining the essential concepts of Physics as well as other scientific and mathematical subjects, including worked-out examples of problems. We will be making extensive use of Khan Academy resources, and you will have assigments to complete there. TwuPhysics is also an excellent resource for videos that explain physics concepts clearly and concisely. The Mechanical Universe series of videos on YouTube is very good, especially if you are taking or have some background in calculus. Finally, many universities also have their lectures available for public viewing online. MIT Open Courseware is an excellent example. Finally, I am available for tutoring – make use of that
8. **Have fun!** Physics can be a lot of fun, and it's easier to learn when you're having fun.



"A person who never made a mistake never tried anything new." -- Albert Einstein

Parents, if you have any questions or concerns, please do not hesitate to contact me at sbouldin@pasco.k12.fl.us

(*Please detach, complete, and return the section below.*)

STUDENTS WILL ALSO NEED TO ACCESS THE PCS CANVAS SITE TO DOWNLOAD AND PRINT VARIOUS MATERIALS. IF YOU DO NOT HAVE ACCESS TO A COMPUTER AND PRINTER, PLEASE LET ME KNOW.

I HAVE READ AND UNDERSTOOD THE ABOVE DESCRIPTION OF THE AP PHYSICS 1 COURSE.

Student Name_____ Student E-mail_____

Parent Signature_____ Parent E-mail_____