AP® Physics 1

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Course Introduction

AP® Physics 1 is an algebra-based course in general physics equivalent in content and depth to that of college freshmen level physics.

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.

AP Physics is fast-paced, in-depth, and rigorous. As such, regular attendance and homework completion are paramount for success.

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.

Academic Goals for the Course

1) Students will develop an understanding of the concepts underlying classical physics.
2) Students will apply their understanding of physics concepts to new and unfamiliar situations to solve problems, analyze systems, propose hypotheses, and design experiments.

Topical Course Outline

Unit 1 – Kinematics
Vectors and Scalars
One-dimensional motion
Two-dimensional motion and projectiles
Rotational Kinematics

Unit 2 - Dynamics
Newton's Laws of Motion
Weight, Normal forces. Tension, and friction
Inclined planes
Pulleys and coupled masses

Unit 3 – Work. Energy, and Energy Conservation
Work
Kinetic and Potential Mechanical Energy
Work-Energy Theorem
Conservation of Energy
Hooke's Law
Elastic Potential Energy

Unit 4 – Momentum and Its Conservation
Linear momentum
Impulse and Collisions
Torque
Angular Momentum
Rotational Energy

Unit 5 – Circular Motion and Gravitation
Uniform circular motion
Universal Gravitation
Orbital Motion and Kepler's Laws

Unit 6 – Simple Harmonic Motion and Waves
Simple Pendulum
Mass-spring systems
Wave Characteristics
Wave Propagation
Mechanical and EM Waves
Doppler Effect
Interference and superposition
Standing Waves

Unit 7 – Electrostatics
Charge and Electric Fields
Coulomb's Law
Electric Potential Energy and Voltage

Fields and Potentials of multi-charge systems
Conductors and Insulators

Unit 8 - Simple DC Circuits
Current, Voltage, Resistance, and Electric Power
Ohm's Law
Series Circuits
Parallel Circuits
Combination Circuits
Kirchoff's Laws
Circuit Analysis

Unit 9 – Course Review and AP Exam Prep

Laboratory Component: Approx. 20-25% of the course will be devoted to laboratory experiences (subject to NTI restrictions, should they be in place). Students develop an understanding of experimental procedure, data collection and analysis, and the communication of experimental results. The following is a sample of lab experiences in the course. These experiences may be real-world or virtual through online lab activities.

1. Car Velocity Lab: students determine the velocity and acceleration of a toy car.
2. Reaction Time: students figure out a method to determine their reaction time.
3. Projectile Motion 1: students determine the landing location of a ball launched horizontally from a table.
4. Projectile Motion 2: students have to shoot a ball through a hoop placed at a particular location when launched at an angle.
5. Force Table and Vectors: students determine missing forces to produce translational equilibrium.
6. Atwood's Machine: students determine the formula for the acceleration of a simple Atwood's machine.
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
8. Galileo Ramps: students use ramps at different angles to determine what happens to the acceleration.
9. Kepler Exoplanet Data: students determine Kepler's laws by analyzing actual data. Inquiry Investigation
10. Hooke's Law: students determine the relationship between distance stretched and force.
11. Pendulum Properties: students determine what factors affect the period of a pendulum
12. Momentum and Collisions: students determine momentum before and after in different types of collisions.
13. Car Crash Physics: students design a car that will safely protect an egg in a crash.
14. Ballistics Pendulum: students determine the initial speed of a "bullet
15. Energy to Work Lab: students determine how work changes energy.
16. Torque Lab: students determine factors that affect the rotational motion of an object.
17. Rolling Cylinders: students determine how the type of cylinder rolled affects time of roll.
18. Flying Pigs and Centripetal Force: students determine the factors that affect centripetal force.
19. Coulomb's Law: students determine the relationship between force, charge and distance between charges.

20. Electric Circuit Lab: students determine voltage and current relationships in simple circuit orientations (series and parallel).
21. Resonance Apparatus Lab: students determine the speed of sound by using resonance in a tube. Guided-Inquiry Investigation
22. Beats and Standing Waves: students determine how beats and standing waves are produced.

Additional Course Information

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. During student-directed labs the students are given an objective, e.g. "Determine the acceleration due to gravity on Earth." Students are allowed to create their own experimental design and collect data, which can be analyzed through graphical methods.

Descriptive and explanatory writing is an integral part of the AP Physics 1 Exam. As such, students will keep a physics journal and complete specific writing assignments corresponding to lab activities. The writing assignments will help students develop the skills for effective, accurate communication of experimental design, analysis, and conclusions, while also serving as an indicator of conceptual understanding. In other words, students must not only be able to apply concepts in order to solve problems, they must also be able to explain clearly what concepts they applied, why those concepts were applicable, any relevant relationships, and presents a logical progression in written form that details their problem solving process.

It is important to note that, on the AP exam, correct solutions are only a small part of the point value for any given free-response question. Most of the point value lies in the student's problem-solving methodology, concept application, and explanatory ability. To put it bluntly, the work that produces a solution is worth more than the solution itself. Students who cannot or will not "show their work" typically do not fare well in the course or on the exam.

Academic Expectations:

1. Come to class with the required materials (pen/pencil, binder or notebook, and calculator. Students do not need to bring their textbook to class unless given prior notice by the teacher.
2. Have any assignments and lab reports ready to turn in at the beginning of the block. This includes having your papers labeled and stapled. Any papers that are not ready when called for will be considered late.
3. Tests are always announced in advance and will be preceded by a review the block before. **Missing the review day does not excuse a student from the expectation of taking the unit exam on the assigned day**. Any exceptions to this policy must be discussed in advance with Mr. Cox.
4. The AP College Board recommends that a lab notebook be kept for potential college lab credit.
5. When a student is absent, it is the student's responsibility to check with their instructor and complete/submit any missing assignments.
6. There will be a comprehensive final exam given at the end of each semester.

School Wide Expectations

1. Follow the 10/10. Hall passes available only after ten minutes into the block, until ten minutes before the end of the block.
2. Report to class on time.
3. Follow all school rules.

Masks and Sanitation

Students are required to wear masks at all times except in cases where social distancing can be maintained. This determination is based on the number of students in a given classroom and the square footage of that classroom. THIS IS NON-NEGOTIABLE.

Class will wrap up a few minutes before the bell rings so that the teacher can sanitize desks, door knobs, etc. prior to the class change.

NTI (Non-Traditional Instruction)

In these uncertain times it may become necessary to close schools again due to COVID-19 cases in the school or community. In this case those students attending school in-person will continue their classes from home. NTI is the teachers' plan of action to continue classes for those in-person students.

Should NTI become necessary, this class will continue uninterrupted with daily lessons posted as videos online by the teacher. Links to those videos, as well as any assignments or supplemental information, will be posted in the teacher's Google classroom. Students will be expected to watch the lessons every school day and complete the assignments as before.

Keys to Success:

AP Physics 1 is a challenging course and to be successful you will have to put forth your best efforts on a regular basis. As with any new activity or material, it takes time, dedication, practice, and lots of patience to reach your goal. If you are willing to put forth the effort to read, think, listen, and ask lots of questions, I know that you can be successful. I am committed to helping you in that regard by using the feedback that I get from you (both formal and informal) to guide my lessons and by making myself available to answer your questions (both in and outside of class).

Grading:

Each grading period will have a running grade based on work and assessments from the students. The 'work' category includes all products from students with the exception of unit exams. This includes homework, practice sets, labs, quizzes, etc. The work category is weighted to 40% of the students' running grade.

The 'assessment' category is comprised of unit exams and is weighted to 60% of the students' running grade.

The running grade is then weighted to 80% of the semester grade. The remaining 20% of the semester grade is the cumulative semester final exam.

Each semester is a standalone grade for one credit. (AP Physics 1A and AP Physics 1B each receive their own grade and are independent of each other)

Grade Calculation:

{[0.8][(work x 0.40) + (assessments x 0.6)]} + [0.2 x final exam]

*The AP grading scale is used for letter grade determination