

## About the Advanced Placement Program<sup>®</sup> (AP<sup>®</sup>)

The Advanced Placement Program<sup>®</sup> enables willing and academically prepared students to pursue college-level studies — with the opportunity to earn college credit, advanced placement, or both — while still in high school. AP Exams are given each year in May. Students who earn a qualifying score on an AP Exam are typically eligible, in college, to receive credit, placement into advanced courses, or both. Every aspect of AP course and exam development is the result of collaboration between AP teachers and college faculty. They work together to develop AP courses and exams, set scoring standards, and score the exams. College faculty review every AP teacher's course syllabus.

## AP Physics Program

The AP Program offers four physics courses: AP Physics 1: Algebra-based, AP Physics 2: Algebra-based, AP Physics C: Mechanics, and AP Physics C: Electricity and Magnetism.

Guided by the National Research Council and National Science Foundation, the AP Program collaborated with college and university educators and AP teachers to develop two, yearlong AP Physics courses to replace AP Physics B.

AP Physics 1: Algebra-based and AP Physics 2: Algebra-based are the equivalent of the first and second semesters of an introductory, algebra-based Physics college course. Because these courses are intended to be yearlong courses, teachers have time to foster deeper conceptual understanding through student-centered, inquiry-based instruction. Students have time to master foundational physics principles while engaging in science practices to earn credit or placement.

In addition, there are two AP Physics C courses: Physics C: Mechanics and Physics C: Electricity and Magnetism. Each corresponds to one semester of an introductory, calculus-based college course. Physics C: Mechanics is taught prior to Physics C: Electricity and Magnetism.

## AP Physics 1: Algebra-Based Course Overview

AP Physics 1 is an algebra-based, introductory college-level physics course. Students cultivate their understanding of Physics through inquiry-based investigations as they explore topics such as Newtonian mechanics (including rotational motion); work, energy, and power; mechanical waves and sound; and introductory, simple circuits.

### LABORATORY REQUIREMENT

This course requires that 25 percent of the instructional time will be spent in hands-on laboratory work, with an emphasis on inquiry-based investigations that provide students with opportunities to apply the science practices.

### RECOMMENDED PREREQUISITES

There are no prerequisite courses.

Students should have completed geometry and be concurrently taking Algebra II or an equivalent course.

Although the Physics 1 course includes basic use of trigonometric functions, this understanding can be gained either in the concurrent math course or in the AP Physics 1 course itself.

## AP Physics 1 Course Content

Students explore principles of Newtonian mechanics (including rotational motion); work, energy, and power; mechanical waves and sound; and introductory, simple circuits. The course is based on six Big Ideas, which encompass core scientific principles, theories, and processes that cut across traditional boundaries and provide a broad way of thinking about the physical world. The following are Big Ideas:

- Objects and systems have properties such as mass and charge. Systems may have internal structure.
- Fields existing in space can be used to explain interactions.
- The interactions of an object with other objects can be described by forces.
- Interactions between systems can result in changes in those systems.
- Changes that occur as a result of interactions are constrained by conservation laws.
- 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.

## Science Practices

Students establish lines of evidence and use them to develop and refine testable explanations and predictions of natural phenomena. Focusing on these disciplinary practices enables teachers to use the principles of scientific inquiry to promote a more engaging and rigorous experience for AP Physics students. Such practices require that students:

- Use representations and models to communicate scientific phenomena and solve scientific problems;
- Use mathematics appropriately;
- Engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course;
- Plan and implement data collection strategies in relation to a particular scientific question;
- Perform data analysis and evaluation of evidence;
- Work with scientific explanations and theories; and
- Connect and relate knowledge across various scales, concepts, and representations in and across domains.

## Inquiry-Based Investigations

Twenty-five percent of instructional time is devoted to hands-on laboratory work with an emphasis on inquiry-based investigations. Investigations will require students to ask questions, make observations and predictions, design experiments, analyze data, and construct arguments in a collaborative setting, where they direct and monitor their progress.

## AP Physics 1 Exam Structure

### AP PHYSICS 1 EXAM: 3 HOURS

#### Assessment Overview

Exam questions are based on learning objectives, which combine science practices with specific content. Students learn to

- Solve problems mathematically — including symbolically
- Design and describe experiments and analyze data and sources of error
- Explain, reason, or justify answers with emphasis on deeper, conceptual understanding
- Interpret and develop conceptual models

#### Format of Assessment

**Section I:** Multiple Choice: 50 Questions | 90 Minutes | 50% of Exam Score

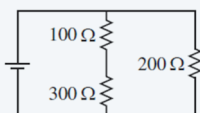
- Discrete items
- Items in sets
- Multi-select items (two options are correct)

**Section II:** Free Response: 5 Questions | 90 Minutes | 50% of Exam Score

- Experimental Design (1 question)
- Quantitative /Qualitative Translation (1 question)
- Short Answer (3 questions, one requiring a paragraph-length response)

## AP PHYSICS 1 SAMPLE EXAM QUESTIONS

### Sample Multiple-Choice Question

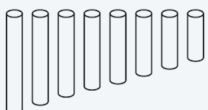


1. The figure above shows three resistors connected in a circuit with a battery. Which of the following correctly ranks the energy  $E$  dissipated in the three resistors during a given time interval?

- (A)  $E_{300\Omega} > E_{200\Omega} > E_{100\Omega}$
- (B)  $E_{300\Omega} > E_{100\Omega} > E_{200\Omega}$
- (C)  $E_{200\Omega} > E_{300\Omega} > E_{100\Omega}$
- (D)  $E_{200\Omega} > E_{100\Omega} > E_{300\Omega}$

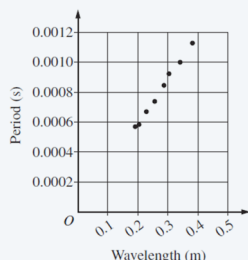
Correct Answer: C

### Sample Free-Response Question: Experimental Design



You are given a set of chimes that consists of eight hollow metal tubes open at both ends, like those shown at left. The chimes are played by striking them with a small hammer to produce musical sounds. Your task is to use the chimes to determine the speed of sound in air at room temperature. You have available a set of tuning forks and other common laboratory equipment but are not allowed to use electronic equipment, such as a sound sensor. (A tuning fork vibrates when struck and produces sound at a particular frequency, which is printed on the tuning fork.)

- (A) Describe your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.
- (B) Describe how you will use your measurements to determine the speed of sound in enough detail so that another student could duplicate your process.
- (C) Describe one assumption you made about the design of your experiment, and explain how it might affect the value obtained for the speed of sound.



- (D) A student doing a different experiment to determine the speed of sound in air obtained wavelength and period measurements and created the following plot of the data. Use the graph to calculate the speed of sound and include an explanation of your method.

Learn more: [apcentral.collegeboard.org/apphysics1](http://apcentral.collegeboard.org/apphysics1)

For complete details of the Curriculum Framework, visit [collegeboard.org/apphysicscurriculumframework](http://collegeboard.org/apphysicscurriculumframework).

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