AP® Physics 1: Algebra-Based

About the Advanced Placement Program® (AP®)
The Advanced Placement Program® has enabled millions of students to take college-level courses and 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** is a full-year course that is the equivalent of a first-semester introductory college course in algebra-based physics.
- **AP Physics 2: Algebra-Based** is a full-year course, equivalent to a second-semester introductory college course in physics.
- **AP Physics C: Mechanics** is a half-year course equivalent to a semester-long, introductory calculus-based college course.
- **AP Physics C: Electricity and Magnetism**, a half-year course following Physics C: Mechanics, is equivalent to a semester-long, introductory calculus-based college course.

Each unit is broken down into teachable segments called topics. In addition, the following big ideas serve as the foundation of the course, enabling students to create meaningful connections among concepts and develop deeper conceptual understanding:

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

AP Physics 1 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 these topics: kinematics, dynamics, circular motion and gravitation, energy, momentum, simple harmonic motion, torque and rotational motion.

PREREQUISITES
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.

LABORATORY REQUIREMENT
This course requires that 25% of instructional time be spent in hands-on laboratory work, with an emphasis on inquiry-based investigations that provide students with opportunities to demonstrate the foundational physics principles and apply the science practices. Colleges may require students to present their laboratory materials from AP science courses before granting college credit for laboratory work, so students are encouraged to retain their notebooks, reports, and other materials.

AP Physics 1 Course Content
The course content is organized into seven commonly taught units, which have been arranged in the following suggested, logical sequence:

- **Unit 1**: Kinematics
- **Unit 2**: Dynamics
- **Unit 3**: Circular Motion and Gravitation
- **Unit 4**: Energy
- **Unit 5**: Momentum
- **Unit 6**: Simple Harmonic Motion
- **Unit 7**: Torque and Rotational Motion
**AP Physics 1 Exam Structure**

**Assessment Overview**
The AP Physics 1 Exam assesses student application of the science practices and understanding of the learning objectives outlined in the course framework. The exam is 3 hours long and includes 50 multiple-choice questions and 5 free-response questions. The 5 free-response questions may appear in any order. A four-function, scientific, or graphing calculator is allowed on both sections of the exam.

**Format of Assessment**

<table>
<thead>
<tr>
<th>Section I:</th>
<th>Multiple-choice</th>
<th>50 Questions</th>
<th>90 Minutes</th>
<th>50% of Exam Score</th>
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</thead>
<tbody>
<tr>
<td>● 45 single-select multiple-choice questions (discrete or in sets).</td>
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<tr>
<td>● 5 multiple-select multiple-choice items (all discrete).</td>
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<table>
<thead>
<tr>
<th>Section II:</th>
<th>Free-response</th>
<th>5 Questions</th>
<th>90 Minutes</th>
<th>50% of Exam Score</th>
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</thead>
<tbody>
<tr>
<td>● Question 1: Experimental Design (12 points).</td>
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<td>● Question 2: Qualitative/Quantitative Translation (12 points).</td>
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<td>● Question 3: Paragraph Argument Short Answer (7 points).</td>
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<td>● Questions 4 and 5: Short Answer (7 points each).</td>
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**Exam Components**

### Sample Multiple-Choice Question

A block is held at rest against a compressed spring at point A at the top of a frictionless track of height $h$, as show. The block is released, loses contact with the spring at point B, and slides along the track until it passes point C, also at height $h$. How do the potential energy $U$ of the block-Earth system and the kinetic energy $K$ of the block at point C compare with those at point A?

- (A) $U_C = U_A$
- (B) $U_C = U_A$
- (C) $U_C > U_A$
- (D) $U_C > U_A$

Correct Answer: B

### Sample Free-Response Question: Paragraph Argument Short Answer

A spring with unstretched length $L_1$ is hung vertically, with the top end fixed in place, as shown in Figure 1. A block of mass $M$ is attached to the bottom of the spring, as shown in Figure 2, and the spring has length $L_2 > L_1$ when the block hangs at rest. The block is then pulled downward and held in place so that the spring is stretched to a length $L_3 > L_2$, as shown in Figure 3.

(A) On the dot, which represents the block in Figure 3, draw and label the forces (not components) exerted on the block. Each force must be represented by a distinct arrow starting on, and pointing away from, the dot.

(B) The student releases the block. Consider the time during which the block is moving upward toward its equilibrium position and the spring length is still longer than $L_2$.

In a clear, coherent paragraph-length response that may also contain diagrams and/or equations, indicate why the total mechanical energy is increasing, decreasing, or constant for each of the systems listed below.

- System 1: The block
- System 2: The block and the spring
- System 3: The block, the spring, and Earth

Use $E_1$, $E_2$, and $E_3$ to denote the total mechanical energy of systems 1, 2, and 3, respectively.

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Educators: apcentral.collegeboard.org/courses/ap-physics-1
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