AP® PHYSICS C: ELECTRICITY & MAGNETISM

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 to receive college credit and/or placement into advanced courses in college. 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 is a full-year course that is the equivalent of a first-semester introduction college course in algebra-based physics.

AP Physics 2 is a full-year course, equivalent to a second-semester introductory college course in physics. The course covers fluid mechanics; thermodynamics; electricity and magnetism; optics; and quantum, atomics, and nuclear physics.

AP Physics C: Mechanics is a half-year course equivalent to a semester-long, introductory calculus-based college course. It covers kinematics; Newton's laws of motion; work, energy, and power; systems of particles and linear momentum; circular motion and rotation; and oscillations and gravitation.

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 and covers electrostatics; conductors, capacitors, and dielectrics; electric circuits; magnetic fields; and electromagnetism.

AP Physics C: Electricity and Magnetism Course Overview

AP Physics C: Electricity and Magnetism is a one-semester, calculus-based, college-level physics course, especially appropriate for students planning to specialize or major in physical science or engineering. The course explores topics such as electrostatics; conductors, capacitors, and dielectrics; electric circuits; magnetic fields; and electromagnetism. Introductory differential and integral calculus is used throughout the course.

LABORATORY REQUIREMENT

AP Physics C: Electricity and Magnetism should include a hands-on laboratory component comparable to a semester-long introductory college-level physics laboratory. Students should spend a minimum of 20 percent of instructional time engaged in hands-on laboratory work. Students ask questions, make observations and predictions, design experiments, analyze data, and construct arguments in a collaborative setting, where they direct and monitor their progress. Each student should complete a lab notebook or portfolio of lab reports.

PREREQUISITE

Students should have taken or be concurrently taking calculus.

AP Physics C: Electricity and Magnetism Course Content

The AP Physics C: Electricity and Magnetism course applies both differential and integral calculus, and builds upon the AP Physics C: Mechanics course by providing instruction in each of the following five content areas:

- Electrostatics
- Conductors, capacitors, and dielectrics
- Electric circuits
- Magnetic fields
- Electromagnetism

Learning Objectives for Laboratory and Experimental Situations

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

- Design experiments
- Observe and measure real phenomena
- Organize, display and critically analyze data
- Analyze sources of error and determine uncertainties in measurement
- Draw inferences from observations and data
- Communicate results, including suggested ways to improve experiments and proposed questions for further study

A minimum of 20 percent of instructional time is devoted to hands-on and inquiry-based laboratory investigations.

AP Physics C: Electricity and Magnetism Exam Structure

AP PHYSICS C: ELECTRICITY AND MAGNETISM EXAM: 1 HOUR, 30 MINUTES

Assessment Overview

The AP Physics C: Electricity and Magnetism Exam includes questions posed in a laboratory or experimental setting. Questions assess understanding of content as well as experimental skills. The exam may also include questions that overlap several major topical areas or questions on miscellaneous topics such as identification of vectors and scalars, vector mathematics, or graphs of functions.

Students will be allowed to use a four-function, scientific, or graphing calculator on the entire AP Physics C: Mechanics and AP Physics C: Electricity and Magnetism Exams. Scientific or graphing calculators (including the approved graphing calculators listed at www.collegeboard.org/ap/calculators) cannot have any unapproved features or capabilities.

Format of Assessment

Section I: Multiple Choice | 35 Questions | 45 Minutes | 50% of Exam Score

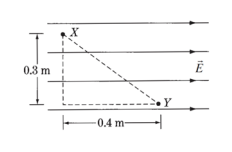
- Individual Questions
- Questions in Sets

Section II: Free Response | 3 Questions | 45 Minutes | 50% of Exam Score

- Laboratory Based
- Discrete Questions

AP PHYSICS C : ELECTRICITY AND MAGNETISM SAMPLE EXAM QUESTIONS

Sample Multiple-Choice Question



A uniform electric field **E** of magnitude 6,000 V/m exists in a region of space as shown above. What is the electric potential difference, $V_X - V_Y$, between points *X* and *Y*?

(a) -12,000 V

(b) 0 V

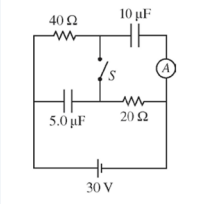
(c) 1,800 V

(d) 2,400 V

(e) 3,000 V

Correct Answer: D

Sample Free-Response Question



In the circuit illustrated above, switch *S* is initially open and the battery has been connected for a long time.

(a) What is the steady-state current through the ammeter?

(b) Calculate the charge on the 10 μF capacitor.

(c) Calculate the energy stored in the 5.0 μF capacitor. The switch is now closed, and the circuit comes to a new steady state.

(d) Calculate the steady-state current through the battery.

(e) Calculate the final charge on the 5.0 μF capacitor.

(f) Calculate the energy dissipated as heat in the 40 ohm resistor in one minute once the circuit has reached steady state.

Educators: apcentral.collegeboard.org/apphysicsceandm

Students: apstudent.collegeboard.org/apphysicsceandm

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