AP® Physics C (Mechanics)

Syllabus 4

Text

Fundamentals of Physics, 7th ed., by Halliday/Resnick/Walker, 2005, John Wiley & Sons.

Course Description

This course is equivalent to a first-year college physics class and is designed to prepare students for the AP® Physics C Mechanics Exam given in May. This course follows the syllabus for that examination, and students passing the exam may receive college credit. The course requires and employs a basic understanding of calculus (differentiation and integration), and also requires a prior course, Honors Physics. The prerequisite calculus course may be taken concurrently. **[C8]**

C8— Introductory differential and integral calculus is used throughout the course.

Typically, four classes per week will be devoted to classwork and lecture, and one class per week will be laboratory work. **[C9]**

C9—The course includes a laboratory component comparable to a semester-long, college-level physics laboratory. Students spend a minimum of 20 percent of instructional time engaged in laboratory work. A hands-on laboratory component is required. Each student should complete a lab notebook or portfolio of lab reports. Note: Online course providers utilizing virtual labs (simulations rather than hands-on) should submit their laboratory materials for the audit. If these lab materials are determined to develop the skills and learning objectives of hands-on labs, then courses which use these labs may receive authorization to use the "AP" designation. Online science courses authorized to use the "AP" designation will be posted on the AP Central® Web site.

In this course, we will focus on two major activities

- Discovery of concepts via scientific inquiry and critical thinking skills. Much of the teaching you will do for yourself and for each other. I will provide you with some introduction and background. Then I will assign to you a task, problem, or question (perhaps more than one at a time). You will work individually or in groups, often with hands-on equipment and materials, to complete the task. Often, you will be asked to present your solutions to the class and/or to critique or verify the solutions of others. My hope is that you will see that there can be more than one way to solve the same problem. **[C7]**

- Laboratory application of physics knowledge (described below).

C7—The course utilizes guided inquiry and student-centered learning to foster the development of critical thinking skills.

Course Evaluation

Your grade will be based on the following:

Exams	40%
Homework	20%
Laboratory	20%
Final	20%

Laboratory

Students will work in small groups to perform weekly student-conducted, mostly hands-on laboratory assignments, but each student must write his or her own report. Students are to keep a portfolio of all laboratory investigations and reports. Laboratories are included in the schedule below. **[C9]** Most labs begin as a problem for which the students must propose and develop their own solution. They then conduct an experiment to test their ideas, make observations, and take measurements. Finally, they form conclusions based on their collected measurements, observations, and data and error analysis. **[C7]**

C9—The course includes a laboratory component comparable to a semester-long, college-level physics laboratory. Students spend a minimum of 20 percent of instructional time engaged in laboratory work. A hands-on laboratory component is required. Each student should complete a lab notebook or portfolio of lab reports. Note: Online course providers utilizing virtual labs (simulations rather than hands-on) should submit their laboratory materials for the audit. If these lab materials are determined to develop the skills and learning objectives of hands-on labs, then courses which use these labs may receive authorization to use the "AP" designation. Online science courses authorized to use the "AP" designation will be posted on the AP Central® Web site.

Course Planner

Week 1

Topic: Introduction; What is Physics? Units and Measurements

Lab: Scientific Method—Students duplicate and "rediscover" Galileo's proof of equal acceleration of all falling bodies.

Weeks 2 and 3

Topic: Kinematics in 1D; Kinematics in 2D. **[C1]**

Students integrate Force–Displacement graph and determine work **[C8]**

Labs: A Projectile in Motion—Students study range and "hang time" of projectiles using launcher in lab. They show derivative/integral relationships between position, velocity and acceleration. **[C8]**

C7—The course utilizes guided inquiry and student-centered learning to foster the development of critical thinking skills.

Weeks 4 and 5

Topic: Mechanics and Newton's Laws of Motion **[C2]**

Labs: Students will use Atwood machine to demonstrate and verify Newton's First Law.

Students will evaluate friction on an incline.

C1—Kinematics

Weeks 6 and 7

Topic: Work and Energy, Conservation of Energy **[C3]**

Labs: Students will prove transfer of potential to kinetic energy using a launch ramp and steel ball. The lab will tie in to projectile motion.

Students will demonstrate Hooke's Law.

Students will perform "student power" lab using stairs. **[C3]**

C8— Introductory differential and integral calculus is used throughout the course.

C2—Newton's laws of motion

C3—Work, energy, and power

Weeks 8 and 9

Topic: Momentum and Collisions, Systems of Particles **[C4]**

Labs: Students will use Pasco cars to demonstrate conservation of momentum.

Students will use Pasco cars to investigate impulse.

C4—Systems of particles, linear momentum

Weeks 10, 11 and 12

Topic: Rotational Kinematics, Rotational Dynamics and Circular Motion **[C5]**

Labs: Students will use pulley and weight to investigate moment of inertia.

Students will use pulley and weight to study conservation of angular momentum.

C5—Circular motion and rotation

Weeks 13 and 14

Topic: Simple Harmonic Motion **[C6]**

Labs: Students will use spring–mass system to study oscillations.

Students will use motion detector to model oscillations.

C6—Oscillations and gravitation

Weeks 15 and 16

Topic: Gravitation **[C6]**

Labs: Students will do simple pendulum lab to determine *g*.

Students will use software in the lab to model elliptical orbits and use calculus to prove that Kepler's Second Law is equivalent to the law of conservation of angular momentum. **[C8]**

C8—Introductory differential and integral calculus is used throughout the course.

Weeks 17 and 18

Review and final exam