AP Physics C: Mechanics Summer Assignment
Dwight Morrow High School & Academies @ Englewood
2018 - 2019

Welcome to AP Physics C: Mechanics; this coming year we will completely answer the question: "What is the classical motion, in three dimensions, of a point like mass under the influence of an arbitrary number of forces?" This is the starting point for all of physics (the fundamental particles which make up everything in the universe are point particles, quantum particles rather than classical particles.

It is imperative that you complete **all** work in a timely manner. We will move faster than you are used to, and I expect a great deal from you.

If you begin to fall behind or are having trouble, it is essential to immediately make time to see me about it. We will set a tutorial hour the first week of class.

This assignment will take you time. Do not wait until the last week to complete it. It will count as a test grade, a lab grade, and set you up for success in the course. We will be using calculus concepts before they are covered in math class.

Do not languish on a question. If you find something difficult, attempt to solve it (show some ORGANIZED work) then move on. Return to it later (at least 10 minutes) and try again. If you need help, talk to your peers first, then if the issue persists, send me an email jsloane@epsd.org

Step 1: Read the course policies page.
Step 2: Complete the vectors[1] unit on Khan Academy. Take screenshots of each quiz and test.
You must take notes. I also recommend that you do the practice for yourself.
You will use vectors all year; many physical quantities are vector quantities.
Step 3: Complete the following Differential Calculus units on Khan Academy (+Notes):
Introduction to Differential Calculus[2]
Derivative as slope of tangent line[3]
Derivatives as instantaneous rates of change[4]
Step 4: Complete the lab – this lab **only** does not need to be in your lab book.

On the first day of class, you should have:

- A binder (strongly recommended) or notebook dedicated to physics.
- A pen (and a pencil if you like).
- Screenshot of your completed Khan academy work; notes on the mathematics.
  - Full quizzes shown.
  - Showing videos are watched.
- Your lab notes – in pen.
- Your completed lab write up.

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[1] https://www.khanacademy.org/math/precalculus/vectors-precalc
[2] https://www.khanacademy.org/math/differential-calculus/derivative-intro-dc/intro-to-diff-calculus-dc/v/newton-leibniz-and-usain-bolt
[3] https://www.khanacademy.org/math/differential-calculus/derivative-intro-dc/derivative-as-tangent-slope-dc/v/derivative-as-slope-of-tangent-line
[4] https://www.khanacademy.org/math/differential-calculus/derivative-intro-dc/derivative-as-instantaneous-rate-of-change-dc/v/slopes-of-secant-lines

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Course Policies

Responsibility

We are in an AP Class, I expect you to be responsible for yourself and your learning.
We will all respect each other and our learning; this means that class time is for physics.
Everyone experiences the world we are studying, we all have valid viewpoints- some of us bring more practical experience, others bring more mathematical ability, still others bring an intuition. Your contribution is valuable. We will all be wrong at some point in class - including me (please correct me! I'm human and make mistakes).

Class Requirements

You should have a space set aside for physics. You need to bring a binder and pen everyday.
Your notes should be kept in the binder, worksheets and quizzes should be added to it.
You should make a note of when a lab is completed. **Each sheet should be dated**.

Cheating vs Collaboration

Collaboration is when students work together to get the idea of how to approach a problem and then write up their problem separately. Collaboration includes attribution - you should state your collaborators names after your own.

Cheating and collaboration are separate things. There will be assignments where I allow collaboration. Laboratory assignments should almost always be collaborative. Lab reports will be longer assignments and require you to think carefully as well as present your ideas clearly. **Each student is responsible for knowledge of the entire lab.**

Lab Scenario:
Student A writes the introduction, and student B the procedure. They then edit the other's work for correctness, clarity, and cohesiveness. I should not be able to tell that one student made the first draft of a given section. The entire lab should look like the work of a cohesive group. **Each student is responsible for the entire lab,** however one lab report per lab **pair** is acceptable.

Cheating, i.e. sharing homework, lab work, exam answers etc., will earn all parties a zero for the assignment along with referral to the office pursuant to district policy. Cheating on collaborative assignments is, for example, if two lab groups turn in identical copies of a lab report with different names on them.

Lab Policy

Researchers keep a notebook that is a day to day record of what they do, why they do it, and any issues that arise or odd things that are noticed. These odd things are usually the most important. They become central to the analysis or point to new ideas. In the research world, it is usually "huh?" that indicates a discovery.

The lab notebook will be your set of notes from before, during, and after the lab. These notes should be neat, you will need to reference them later. These notes will be useful when you type your lab report. **Your lab report will be submitted as a pdf**, but can be written in your choice of program. I recommend Google Docs, Microsoft Office, Libre Office, or LaTeX (all of these should be free for you). Microsoft through the district, and the others are funded by advertising (google) or are community developed open source projects. If you would like help in getting these to work, please talk to me after class. LaTeX

is likely what you'll use if you go into a field requiring typesetting of equations (research physics or mathematics) though it does have a steeper learning curve.

Rubrics will be given out on the first day of class.
Labs will be graded according to the rubric. Notably, late lab reports will be penalized by 10% per day - including weekend days because they are submitted electronically.

Homework Policy

You will have homework nearly every day. The length of homework will vary. Often it will be between one and three mandatory problems and several optional problems. If you get the mandatory problems wrong, you may move on to the optional work to improve your grade.

Your homework should have a header. It will be worth 5% of each HW. At the top of the page:
Your Name Date Work Done
Physics : Kinematics Problem Set 1

Quizzes
On non-lab days, we will have a do now in the first three minutes and an exit question in the last five. These will form a quiz grade each week. The do-now will generally be a primer for the day's work. The exit question will generally be about the day's work.
Approximately ten points each week of quiz grades.

Tests
Tests will mimic the AP Test in format and difficulty and will be at the end of each unit.

We will cover: Kinematics, Forces & UCM, Momentum, Energy, Systems of Particles, Kinematics of Rotation of Rigid Bodies, Dynamics of Rotation of Rigid Bodies, Gravitation, Simple Harmonic Motion. We will also be using mathematical ideas before they are fully covered in mathematics – that means we'll cover them here too. The full syllabus will be handed out on the first day.

AP Physics C: Mechanics Summer Lab

Please do NOT spend money to complete this lab. If you are having difficulty, contact me.

The goal of this lab is to compare instantaneous values with averaged values of position, velocity, and acceleration. You may work with a single partner (who also is in AP Physics C: Mechanics) on this lab; in this case you must both be present for the experiment and share fully in the data collection and analysis.

On the first day of class, bring a write-up of the experiment you designed. If you work in pairs, each of you must bring a copy of the write-up. Notes taken during the experiment should be in pen and original copies (even if messy) should be retained. If originals are illegible please also recopy them neatly.

Prompt:

After taking their first physics course, a student states that all motion can be described by the kinematic equation: $d(t) = d_0 + v_0 t + \frac{1}{2} a\, t^2$. Develop an experiment to test their statement.

Observational Experiment Design – Complete this section fully before moving on.

Limit yourself to materials that you already have on hand, examples:

- A ball (record the circumference)
- A box to act as a ramp (don't just roll the ball down one ramp)
- A ruler for scale
- A phone (to video the experiment-the video can then be used to make measurements)

Or

- Paper (something about parachutes perhaps)
- String / Thread (something about parachutes perhaps)
- A ruler for scale
- A phone (to video the experiment-the video can then be used to make measurements)

Or choose something else.

What is your goal?

What do you plan to measure?
(Why? What adds uncertainty to your measurements?)

What do you plan to calculate?
(Why? After your measurements will you be able to calculate these? What assumptions are you making? How does the uncertainty influence your calculations?)

Experiment – Complete this **after** completing the design.

Carry out the experiment as you designed it. If you need to modify your design, make a note of why. Keep a record of your data! Do not delete it. As you carry out the experiment, make notes about anything that doesn't go as planned AND anything that might impact your data.

Were your assumptions reasonable? Why or why not? If you made unreasonable assumptions, you might need to redo the experiment after modification. Do NOT destroy data from the first unmodified experiment.

What can you conclude from your experiment?

How might you change your experiment (without adding technology / increasing your budget) to improve the certainty of your conclusion?