AP Physics 1 Summer Assignment 2021

Welcome to AP Physics 1. In order to help ensure that we have a successful year in this course we need to make sure that we tackle some key ideas for this course.

If you are curious about why you should take AP Physics 1 this year, please check out these videos made by previous students. *Please note that I am not endorsing any social media present in the videos. Students included these mentions/ stamps by their own choice. All videos are from the most recent 2020-2021 group of AP Physics 1 students.*

- Zoey and Eloise
- Curtis
- Hanana
- Michelle and Jingyi
- Leonardo

Please start from the top of this checklist and work your way down.

- ☐ Watch this welcome video from Mrs. Russo, telling you about this course, including her expectations and the topic overview.
- ☐ Sign up for our APP1 Remind101. I will send out reminders over the summer and through the school year. To join text @russo-app1 to 81010
    - Parents/guardians are also welcome to sign up but the AP Physics1 students MUST sign up.
- ☐ Read through the course syllabus and make sure that you understand the course expectations and what we will be covering this year.
- ☐ Complete the attached questions highlighting experimental design, algebraic manipulation and derivations.

Assignment Expectations

1. This assignment is due when you walk in to your *first day of class*. ***No exceptions!***
    a. If you have joined AP Physics 1 late, or registered for the class during check-in, you will turn it in to me the very next time the class meets. If you do not meet that deadline you will be removed from the course.
2. All questions must be attempted into order to remain in AP Physics this year.
3. While this is a take-home assignment, you are expected to work on this assignment **BY YOURSELF**. You are not to solicit help from other students, teachers, tutors, parents, etc.
    a. These questions are designed to see how you think and if you can do the algebra necessary for AP Physics 1. This is also designed to see how you handle working through some topics on your own. Independent learning will always be supported with an in-class component, but sometimes we will not be able to teach a topic "from scratch" during that time.
    b. This assignment is also designed to be completed with no prior physics experience. Any physics necessary to know for these questions is either provided in the problem or in the assigned video.
4. This will be a challenge but you should not be focused on getting the "right" answer to these questions. Understand that while you should try your best on them, just making your best attempt at these questions and the perseverance of honestly attempting all the questions in this packet can be the best indicator of your success in AP Physics 1.

On my honor as an IMG Academy student, I pledge that I have upheld all aspects of the IMG Academy Honor Code on this assignment.

*X*_____ *X*_____

Student Name *Student Signature*

Question 1: Experimental Design

As objects move, their motion can be described and mapped through several methods. One of the ways is taking a look at the equation below for an object's position as a function of time.

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

The variables x and x_0 describe the final and initial positions respectively, while v_0 represents the initial velocity and a represents acceleration, and t represents time.

If you are given two carts, one that moves with constant velocity, and one that moves with constant acceleration determine an experimental procedure to find and test where the two cars meet after they are let go from the starting line at the same time.

(a) What quantities would be measured?

(b) Select the lab equipment that should be used from the following list:
(While searching is discouraged on this assignment, you may look up the lab equipment to understand what it is.)

_____ Meterstick	_____ Stopwatch	_____ Balance
_____ High speed video capture	_____ String	_____ Mass Set
_____ Force Sensor/Spring scale	_____ Pulley	_____ Masking Tape

(c) How would this equipment be used (experimental setup)? Set up diagrams are encouraged.

(d) Describe the procedure in enough detail that other students could replicate the experiment.

Question 2: Algebraic Derivations and Applications

a. The following formula is used frequently in AP Physics 1 for objects in flight (or falling).

$$x = x_o + v_o t + ½\, at^2$$

Where *x* is the current height of an object, x_0 is the object's initial height, v_0 is the object's initial velocity, *t* is the length of time the object has been in flight (or falling), and *a* is the object's acceleration (acceleration due to gravity for falling objects).

Solve this equation for time of flight (*t*) when the initial velocity is zero. If a variable is zero, then ONLY that ***term*** can be eliminated from the equation. Please show all steps for arranging this equation solved for the proper term.

b. What would happen to the time of flight if the distance of the drop is doubled? Has the time of flight doubled, more than doubled, less than doubled? Explain briefly. If you are familiar with the concept of the Factor of Change method, this is an excellent place to use it. If you are not familiar with that method, make your best approximation to answer the question.

c. Derive the following formula $v^2 = v_o^2 + 2a(x - x_o)$ using the following formulas:

(1) $x = x_o + v_o t + \frac{1}{2} a t^2$

(2) $v = v_o + at$

You must use these formulas (and only these formulas) and you must SHOW ALL STEPS!!!!!! A derivation is the manipulation of equations for simplification. You are trying to eliminate *t* from the two equations given to get the goal equation. A derivation does not include substituting numbers for your variables. Consider how you might solve one of the two equations to substitute it into the other equation, then rearrange to get the desired formula. [While this is a more complicated derivation, you will need to be able to practice manipulation of formulas and showing all steps of a process for this class.]