Summer Assignment
2020-2021 School Year

AP Physics 1
Mrs. Downing

Welcome to AP Physics 1!

I am so excited that you have chosen to come on this journey with me this year. During your time in class, we will cover a variety of topics ranging from Newtonian mechanics, conservation laws, waves and sound, and static and current electricity. There are two major skills that permeate every unit we cover in physics: a working knowledge and understanding of the applications of vectors and the ability to design, plan, and execute a laboratory investigation. This summer assignment will take you through both of these skills and hopefully get you excited for what is to come! Please read the instructions for this assignment carefully as there are two parts that you will need to complete.

Part 1: Vectors

Vectors are foundational mathematical concept used in physics. Below are the requirements and resources for the first part of this summer assignment.

1. Go to https://www.flippingphysics.com/algebra.html

   - Introductory Concepts – watch video 6 – "A Problem to Review SOH CAH TOA"
   - Go down to "Two-Dimensional Motion" – find the "Vectors and Scalars" section – watch all 7 videos

   As you watch the videos, please take notes and work to understand the fundamentals of vectors. If you need to watch a video more than once, please do that. You need to understand how vectors work and how to do mathematical operations with vectors.

2. Go to: https://www.physicsclassroom.com/Physics-Interactives/Vectors-and-Projectiles.

   Use the following interactives to help build your understanding of vectors. These games help you practice the concepts and gain understanding. Practice enough so you are very comfortable with vectors.
   - Vector Addition
   - Name that Vector
   - Vector Guessing Game
   - Vector Addition: Does Order Matter?

3. Go to: https://www.physicsclassroom.com/Concept-Builders/Vectors-and-Projectiles.

   You need to get ALL trophies for the following concept builders. When you start the concept builder, put your name. Once you have the trophies, take a screen shot and put it in a word document. When you have all four trophies, you can email me the word document.
   - Vector Direction
   - Head-to-Tail Vector Addition
   - Vector Addition
   - Component Addition

   Note: These concept builders are challenging for one main reason – if you get it wrong, the simulation will not tell you WHY you are wrong. You'll have to re-work the problem in order to figure out your mistakes. You will have to show grit and determination to figure out the concept and how to get the right answer. We will model this type of exercise frequently in AP Physics 1 this year and it is important for you to be able to understand your mistakes and re-evaluate a problem in order to approach it correctly.

You will need to email me your trophies by the end of the day on the first day of school.

They will count as your first homework assignment.

Your first quiz will take place during the first week of school and it will cover the topics addressed in this part of the summer assignment.

Part 2: Experimental Design

Your assignment is to build, trouble-shoot and optimize a device that can time an interval of exactly ten seconds, using whatever materials you can find around your house. You will bring your timer to school on the first day of class, where you will compete against your classmates to see whose timer comes closest to exactly ten seconds. You will also be required to turn in a typed lab report describing the design, construction, and operation of your timer. This part of the summer assignment will count as your first lab grade for the year.

You should construct your timer and complete several test runs. You may need to make changes to your timer after each test run. Make note of these changes for your write-up!

The requirements for the timer construction are as follows:

1. Your timer may not use electricity or any kind of clock mechanism, mechanical or electrical.

2. Your timer must perform a minimum of two separate and distinct "actions." A transfer of energy from one physical object to another must occur between one "action" and another. For example, a marble that rolls down a ramp and pushes a lever, which rings a bell would count as two distinct actions: (1) Marble rolls down ramp and hits lever, then (2) Lever swings and hits bell.

3. Your timer may not be an unmodified "off-the-shelf" item. If you use a pre-made device or object as part of your timer, you need to modify it in some substantial way that affects how you use it to measure ten seconds.

4. If your timer does something repetitive, you may count a specific number of repetitions. For example, if the final action of your timer is a ball on a string that winds around a pole, you may measure ten seconds by how long it takes the ball to go around the pole a specific number of times.

5. Your timer may not require human interaction after it has started (except for counting repetitions of some action, as described in rule #4 above).

6. You must declare in advance how your timer will indicate when ten seconds has elapsed. For example, having a gadget that flops around on the floor randomly while you count in your head "one-Mississippi, two-Mississippi..." is not acceptable.

7. You have a maximum of three (3) minutes to set up your timer. You should rehearse this.

8. Students may help each other construct and/or setup on test day, but you must work individually to design, optimize, and test your timer.

9. On test day, I will measure elapsed time using my iPhone. Because of the limits of human reaction time, results within 0.1 s of each other are equivalent.

10. If your timer completes all of its actions in less than eight (8.0) seconds, or greater than twelve (12.0) seconds, you will lose 25% from your grade.

Your write-up should include the following sections:

- Title & Objective: a descriptive title and the objective (purpose) of the experiment;
- Background: your experimental objective and your overall approach to how you will meet it;
- Procedure: a detailed description of how you built your timer and how you operate it (someone else in this class must be able to follow your procedure and replicate what you did)
- Data & Observations: list the time for each of your trial runs (you need a minimum of eight separate data points), and a description of any adjustments/changes you made after each one;
- Analysis: calculations, quantitative (description) and qualitative (numerical) error analysis;
- Conclusion: a 1–2 sentence summary of whether or not you achieved your objective.
- A minimum of one or a maximum of two photographs of the working of your timer.