AP Physics 2 Summer Assignment

Thank you for your interest in continuing your study of physics next year! The summer assignment has three parts:

- Part I should be completed now.
- Part II is an assignment that you must submit via Google classroom. The due date for this assignment is **Saturday August 31, 2019.**
- Part III should be hand written and will be collected on the first day of class in September.
- Part IV is required for students who did not take AP Physics 1, and is optional for others.

Feel free to contact me at dbuchan@bhpsnj.org if you have any questions or concerns. I check my email regularly throughout the summer. I’m looking forward to working with you in September!

Mrs. Buchan

I. Register for the Course

- Many of the documents you will need both for the summer assignment and throughout next year will be posted in Google classroom, and electronic assignments will always be submitted via Google Classroom. Your first task is to enroll in the AP Physics 2 class on Google Classroom. The enrollment code is available on my teacher web site (www.bhpsnj.org/Page/3441). This summer assignment is also posted on the “AP Physics 2 File Library” tab on my web site.

- iPad Apps: Links to several apps you need for class are on the “Links to physics apps” tab on my website (www.bhpsnj.org/Page/7149). Please install these apps on your iPad prior to September. (DataAnalysis and Sparkvue)

II. Experimental Design

Design and perform your own experiment that involves taking quantitative measurements of a physical quantity. Be creative, and do something that reflects your personal interests. The purpose of this assignment is for you to practice writing a clear, concise experimental procedure, such that someone who wasn’t present would be able to replicate your experiment.

- Write a clear, concise procedure for the experiment. Make sure you include every step of the procedure, and describe all equipment you will use. Include either a sketch or a photo of the experimental setup.
- Discuss the assumptions and sources of experimental uncertainty, as well as how you will attempt to minimize the uncertainty.
- Perform the experiment and record the data in a clear data table. Label all data with both quantity and units.
- Analyze the results of your experiment and write a brief conclusion.
- Submit your completed assignment via Google Classroom.
III. Review AP Physics 1
You will be expected to come into September with a solid foundation in Newton’s laws, circular motion, momentum, and energy, along with a strong understanding of electrostatics and DC Circuits. We will not be spending time in class reviewing material from AP Physics 1. You should work through the following to help you review. Answers to the Review Questions are given in Appendix E at the end of the book, and answers to the end-of-chapter Questions and Problems are given in Appendix F. You must write out the solutions to these questions and problems, showing all of your work, including an explanation of the correct answer for the multiple choice questions. This will be collected on the first day of school, and you may be tested on this review material in September.

Review Questions:
- Chapter 2: 2.2 (page 49), 2.4 (page 53)
- Chapter 4: 4.2 (page 124), 4.6 (page 143)
- Chapter 5: 5.2 (page 157)
- Chapter 6: 6.9 (page 218)
- Chapter 14: 14.1 (page 497), 14.4 (page 509)
- Chapter 16: 16.2 (page 581), 16.4 (page 589), 16.7 (page 598), 16.8 (page 601)

End-of-chapter Questions and Problems:
- Chapter 1: Multiple Choice #11
- Chapter 2: Multiple Choice #1, 3, 5; Problems #1, 31, 61, 63, 65
- Chapter 4: Problems #15, 25, 29
- Chapter 5: Multiple Choice #5, 7
- Chapter 6: Problem #33
- Chapter 14: Multiple Choice #1, 3, 7; Problems #1, 3, 7
- Chapter 15: Multiple Choice #1
- Chapter 16: Multiple Choice #1, 3, 5, 7, 9, 11, 13; Problems #15, 23, 33, 43
IV. Proportional Reasoning
Proportional reasoning is a critical component of AP Physics. Here are some basic guidelines:

- Write out the mathematical relationship between the variables in the problem.
- Write down what you know about the relationship between the quantities for object 1 and object 2.
- Plug in the quantities and compare.

Examples:

a) Rectangle A has base B and height H, while rectangle B has base B/2 and height 3H. How does the area of rectangle B compare to the area of rectangle A?

\[
\text{area} = \text{base} \times \text{height} \\
\text{area}_A = B \times H = BH \\
\text{area}_B = (B/2) \times 3H = 1.5 BH \\
\text{The area of rectangle B is } 1.5 \text{ times the area of rectangle A.}
\]

b) The right triangles shown below have angles A and B and sides with lengths as shown. What is the ratio of \(\tan A\) to \(\tan B\)?

\[
\tan \theta = \frac{\text{opposite}}{\text{adjacent}} \\
\tan A = \frac{8}{6} = \frac{4}{3} \\
\tan B = \frac{10}{15} = \frac{2}{3} \\
\text{ratio of } \tan A \text{ to } \tan B = \frac{4}{3} : \frac{2}{3} = 2:1
\]

c) Two cylinders have the same volume, but cylinder B has twice the radius of cylinder A. If cylinder A has height H, what is the height of cylinder B, in terms of H?

\[
\text{Volume} = \pi r^2 h \\
\text{Volume}_A = \pi r^2 H \\
\text{Volume}_B = \pi (2r)^2 h_B \\
\text{Volume}_A = \text{Volume}_B \text{ so } \pi r^2 H = \pi (2r)^2 h_B = 4 \pi r^2 h_B \\
h_B = \frac{\pi r^2 H}{4 \pi r^2} = \frac{H}{4}
\]
Part IV: Proportional Reasoning continued

Practice: (Please work these out on a separate sheet of paper, and submit a picture of your work.

1) By what factor does the volume of a sphere increase if the radius is tripled?

2) By what factor is a 12 inch pizza larger than a 10 inch pizza?

3) Three variables are related by the equation \( P = \frac{F}{A} \). How does the variable F change if P triples and A doubles?

4) Two particles, with charges \( q_1 \) and \( q_2 \) respectively, exert force \( F \) on each other when they are a distance \( r \) apart. Determine the force the two particles exert on each other, in terms, of \( F \), when the variables are changed as described in each of the three experiments below.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>( q_1 )</th>
<th>( q_2 )</th>
<th>( r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Doubled</td>
<td>Doubled</td>
<td>Tripled</td>
</tr>
<tr>
<td>2</td>
<td>Doubled</td>
<td>Halved</td>
<td>One-Quarter</td>
</tr>
<tr>
<td>3</td>
<td>Halved</td>
<td>Tripled</td>
<td>One-Third</td>
</tr>
</tbody>
</table>

(Note: You should work out a different answer for each experiment.)

5) A car and a delivery truck both start from rest. The car accelerates at four times the rate as the truck, however, the truck accelerates for twice the amount of time as the car. The final speed of the truck is \( v_T \). What is the final speed of the car in terms of \( v_T \)?

6) A ball attached to a string is whirled around in a horizontal circle having radius \( r \) at speed \( v \). If the radius of the circle is changed to \( r/4 \) and the same centripetal force is applied by the string, determine the new speed of the ball in terms of \( v \).

7) A hockey puck of mass \( m \) is sitting at rest on ice. A player pushes the puck to the right with a hockey stick exerting a constant force over a time interval. Then the player exerts twice as much force on a second, identical puck over triple the same time interval. The final momentum of the first puck is \( p_1 \). Determine the final momentum of the second puck, \( p_2 \), in terms of \( p_1 \).