

AP Physics 1 Summer Assignment

Welcome to AP Physics! AP Physics is a course which is towards the end of your high school career which means you finally get to apply many of the mathematical concepts (and some science) that you have learned over the years into real world situations. We use algebra, basic trigonometry, and geometry all of the time in physics. It will sometimes feel as if you are in another mathematics class that consists of only word problems. I often say that the hardest part of physics is the algebra, which is true. Once you understand the concepts, the math will come. Do not be discouraged if you do not understand the first or even third time and ask questions!

This course is giving you the opportunity to grow as a critical thinker, problem solver and communicator. I also don't believe the rumors, this course is not impossibly hard. It does require hard work, but so does anything that is worthwhile. AP Physics is immensely rewarding and exciting, but you do have to take notes, study, and maybe even read the book (torture, I know!). But I promise that if you want to (and only if you actually want it), you can absolutely succeed!

The Assignment

The assignment is broken into 4 parts which will cover fundamental concepts that we should know already and should be a refresher. You can also email me and I will do my best to answer.

This assignment is due on the first day of school. You must show all your work in all steps. I highly recommend not waiting until the last minute to start this assignment, but I think we both know that won't happen...

Section	Points Earned	Points Total
Unit Conversion		16
Trigonometry		12
Algebra		25
Graphing		22
Total		70

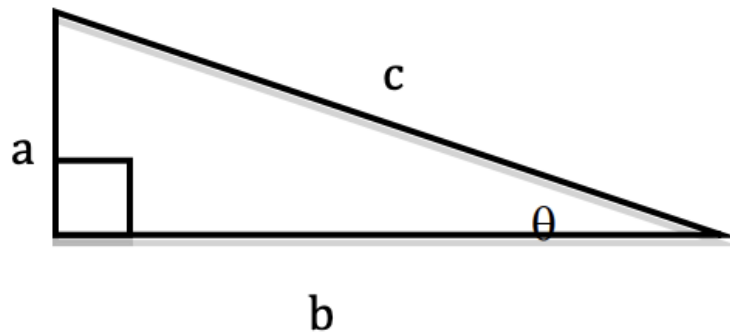
Unit Conversion

1. Finish the SI prefix table below. Follow the example of the centi- prefix (**6 points**).

Symbol	Name	Numerical Equivalent
<i>n</i>		
μ		
<i>m</i>		
<i>c</i>	centi	10^{-2}
<i>k</i>		
<i>M</i>		
<i>G</i>		

2. 15.2 kg is how many grams (**1 point**)?
3. 430 nm is how many meters (**1 point**)?
4. 15 years is how many seconds (You can assume a normal 365 day year) (**2 points**)?
5. $2.45 \times 10^6 \text{ m/s}$ is how many kilometers per hour (**3 points**)?
6. If $2.54 \text{ cm} = 1 \text{ in}$, how many meters are in 1 mile (**3 points**)?

Trigonometry



1. Find a if given b and c (**1 point**).
2. Find a if given c and θ (**1 point**).
3. Find θ if given b and c (**1 point**).
4. If $a = 2.0$ and $c = 7.0$, what is b (**1 point**)?
5. If $c = 10.0$ and $\theta = 60^\circ$, what is b (**1 point**)?
6. If $a = 12.0$ and $\theta = 30^\circ$, what is b (**1 point**)?

(Radians may be unfamiliar to you, but you should learn them in pre-calc before we need them)

7. 360 degrees = _____ radians (**1 point**).
8. 4.5 revolutions = _____ radians (**1 point**).
9. Find the length of an arc with a radius of 6.0 m swept across 2.5 radians (**2 points**).
10. Find the length of an arc with a radius of 10.0 m swept across 100 degrees (**2 points**).

Algebra

1. $v_1 + v_2 = 0$. Solve for v_1 **(1 point)**.
2. $a = \frac{v}{t}$. Solve for t **(1 point)**.
3. $\Delta x = v_i t + \frac{1}{2} a t^2$. Solve for t if $v_i = 0$ **(2 points)**.
4. $T = 2\pi\sqrt{\frac{L}{g}}$. Solve for g **(2 points)**.
5. $\frac{mv^2}{r} = G\frac{Mm}{r^2}$. Solve for v **(2 points)**.
6. $F_f = \mu F_N$ and $F_N = mg\cos\theta$. Solve for μ in terms of F_f , m , g , and θ **(3 points)**.
7. $F = ma$ and $a = \frac{v^2}{r}$. Solve for r in terms of F , m , and v **(3 points)**.
8. $T = 2\pi\sqrt{\frac{L}{g}}$ and $\omega = \frac{2\pi}{T}$. Solve for L in terms of g and ω **(3 points)**.

Consider $z = \frac{x}{y}$, $c = ab$, and $r = \frac{s^2}{t^2}$

9. As x increases and y stays constant, what happens to z **(1 point)**?

10. As y increases and x stays constant, what happens to z **(1 point)**?

11. As a increases and c stays constant, what happens to b **(1 point)**?

12. As c increases and b stays constant, what happens to a **(1 point)**?

13. If s is tripled and t is halved, what happens to r **(2 points)**?

14. If t is doubled and s stays constant, what happens to r **(2 points)**?

Graphing

Frequently an investigation will involve finding out how changing one quantity affects the value of another. The quantity that is deliberately manipulated is called the *independent variable*. The quantity that changes as a result of the independent variable is called the *dependent variable*. The relationship between the independent and dependent variables may not be obvious from simply looking at the written data. However, if one quantity is plotted against the other, the resulting graph gives evidence of what sort of relationship, if any, exists between the variables.

When plotting a graph, take the following steps.

- Identify the independent and dependent variables.
- Choose your scale carefully. Make your graph as large as possible by spreading out the data on each axis.
- All graphs do not go through the origin (0,0). Think about your experiment and decide if the data would logically include a (0,0) point. For example, if a cart is at rest when you start the timer, then your graph of speed versus time would go through the origin. If the cart is already in motion when you start the timer, your graph will not.
- Plot the independent variable on the horizontal (x) axis and the dependent variable on the vertical (y) axis. Plot each data point.
- If the data points appear to lie roughly in a straight line, draw the best straight line you can. Have the line go through as many points as possible with approximately the same number of points above the line as below. **Never connect the dots**. If the points do not form a straight line, draw the best smooth curve possible.
- Title your graph. The title should clearly state the purpose of the graph and include the independent and dependent variables.
- Label each axis with the name of the variable *and the unit*. The graph shown on the next page was prepared using good graphing techniques.

1. You received a graduated cylinder with three identical marbles and an unknown amount of water already in it. You placed extra identical marbles in the cylinder and obtained the data below. Use the data to graph a best-fit line showing the relationship between the water level and the number of marbles. The y-intercept should be visible on the graph. Label your axes and include units. From the graph, determine a mathematical formula for the water level for any number of marbles **(20 points)**.

Number of Marbles in Water	Water level (mL)
3	58
4	61
5	63
6	65
7	68

