AP Physics 1 – Summer Assignment

This assignment is due on the first day of school. You must show all your work in all problems.

AP Physics is a science course that demands an exceptional knowledge of algebra-based mathematics, trigonometry, and geometry. It can sometimes feel like you are in another math class with only word problems. Because much of physics requires the application of algebraic mathematics, it is essential to have a solid foundation before entering this class to be successful.

Google Classroom:
Join the summer assignment Google Classroom using the code *wcazxfe*. I will post some reference videos and course materials for you to review and recommended due dates as guidelines to help divide the assignment. You can also send me questions, and I will reply when I am able.

Things to know about AP Physics:

1. Ignore your grade. You will do well if you focus on the content, do your work on time, and ask questions as often as needed.
2. Conceptual knowledge is more important than math. We will cover concept after concept, and to truly do well in the class, you need to be ready to apply that knowledge in different ways, as the question being asked will always be different from what you expect.
    a. This means you need to be involved in the course and study regularly. If you do so, you can build upon your knowledge and understand the concepts more deeply. We will continue to use topics covered at the beginning of the year throughout the course.
3. Outside resources are your friend. Assigned readings and videos are to help, and you need to do them. I will provide numerous resources for you, so if one does not make sense, try another one. Take notes while reading or watching videos to review later. Study the diagrams, graphs, and equations as well.
    a. Taking effective notes is the key to success in college. Every course and every teacher is different, so find a method that works best for you.
    b. Find your own resources! The internet is full of information, and you can find dozens of people all explaining the same topic. If you find something beneficial, send it to me, and I will share it with the rest of the class.
4. Do not spend an exceptionally long time on one problem. The AP test and exams in class are timed. If you get stuck on a problem, skip it. Often, future problems provide hints or reminders on how to solve your problem.
5. Work together as a class. Help each other out, bounce ideas off each other, and problem-solve together. Find a study group and share quizlets and videos. Use class time effectively. Socializing with friends may be fun, but you will have more work later.
6. Do not cram. This is not a memory-based course. You will need to be able to combine multiple topics to solve one problem. Keeping up with the material and constantly using it helps keep everything fresh and easy to recall. Learn how to solve a problem, not just memorize the steps from one example.

Metric Measurements and Conversions

You should be comfortable using and converting the following metric prefixes. Proper symbols for units, variables, prefixes, etc., are essential, as the wrong symbol could change the entire meaning. These symbols are CaSe SeNsItIvE. Capital and lowercase letters mean different things.

Complete the following table:

Metric Prefix	Symbol	Power
Tera-		
Giga-		
Mega-		
Kilo-	k	10^3
Base Unit	-----	10^0
Centi-		
Milli-		
Micro-		
Nano-		
Pico-	p	10^{-12}

Convert the following units. Solve each problem using dimensional analysis. Show all your work. Every number must have a unit every time, and the answer must be expressed with proper significant figures.

1. Convert 4,200 mg to kg

$$4,200mg \cdot \frac{10^{-3}g}{1mg} \bullet \frac{1kg}{10^{3}g} = 0.0042kg$$

2. 50.0 m to mm

3. 25 cL to kL

4. 0.00332 Mg to kg

5. 457.3 nm to m

6. 39.2 m/s to miles per hour

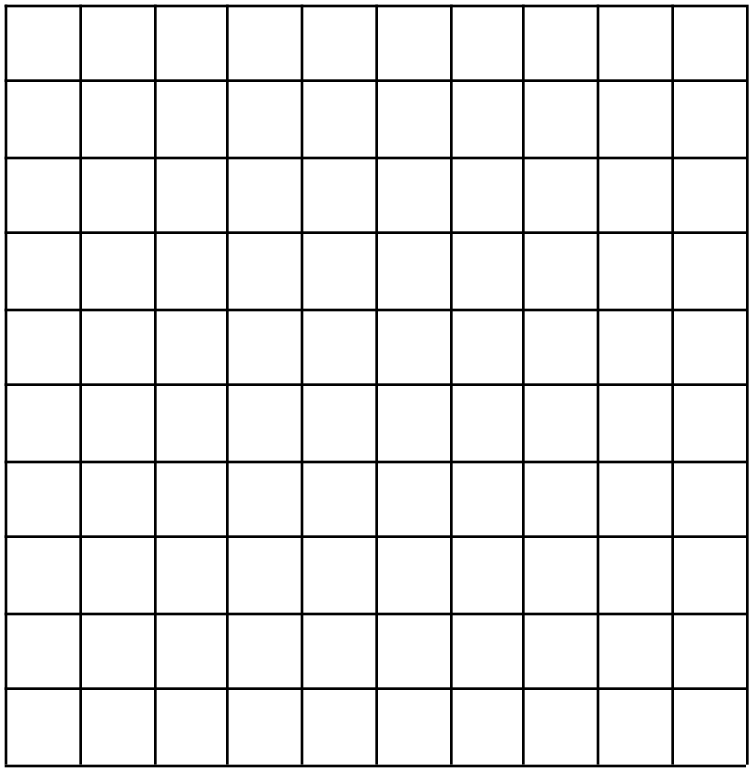
Graphing and Data Analysis

You must be able to create scatter plot graphs from data, draw a best-fit line, and find the equation for that line.

When making graphs, use the graph's axes fully, but do not extend beyond the given space. All axes should be labeled with titles and appropriate units. Graph titles are in the form "y versus x" (ex., Mass versus volume = mass on the y-axis and volume on the x-axis)

1. Create a distance versus time graph of the following data. Include an appropriate scale and all axis labels with units.

Distance (m)	Time (s)
0.0	0.0
3.6	1.0
7.1	2.0
11.1	3.0
14.6	4.0
18.2	5.0



2. Add a best-fit-line using a straight edge.
3. Find the equation of the best-fit-line. Express in y=mx+b form with "d" (distance) and "t" (time) substituted for the appropriate x or y variables.

4. Use your best-fit-line to calculate how long it takes to travel exactly 15.5 meters.

5. Find the area under the curve between 2 and 4 seconds.

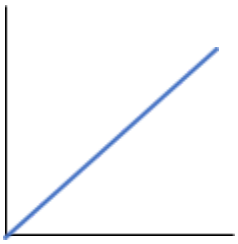
Functions and Relationships

You must be familiar with common functions and their associated proportions and graphs, as covered in Algebra II. Much of physics involves analyzing graphs or equations to understand how variables relate to each other. You need to know how to express functions as mathematical proportions and describe them in words.

Linear:

Proportion: $y \propto x$

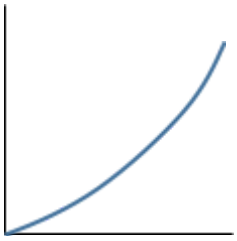
Written: **y** is **linearly** proportional to **x**



Quadratic:

Proportion: $y \propto x^2$

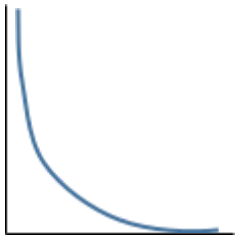
Written: **y** is proportional to $\mathbf{x^2}$



Inverse:

Proportion: $y \propto \frac{1}{x}$ OR $y \propto x^{-1}$

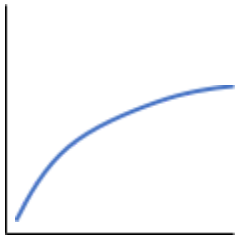
Written: **y** is **inversely** proportional to **x**



Square Root:

Proportion: $y \propto \sqrt{x}$ OR $y \propto x^{\frac{1}{2}}$ OR $y^2 \propto x$

Written: **y** is proportional to the **square root** of **x**



Algebra

You need to be very comfortable solving and manipulating algebraic expressions. While you will have to calculate values using the equations, much of the math we use in this class involves combining equations and solving for new expressions.

Solve the following problems for the variable. List **all** possible answers and round all answers to **3** significant digits. Use **DNE** if a **real** answer does not exist. You must show all your work.

1. $2x + 5 = 7$

2. $5x - 12 = 6 - x$

3. $\frac{3x}{4} + 3 = 6x$

4. $7 - \frac{3}{x} = 5$

5. $\frac{18}{x} + 12 = 9x - \frac{6}{x}$

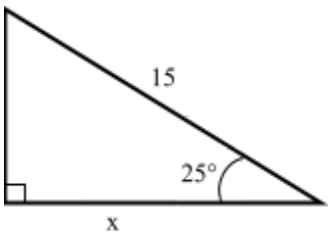
6. $x^2 - 17 = 8$

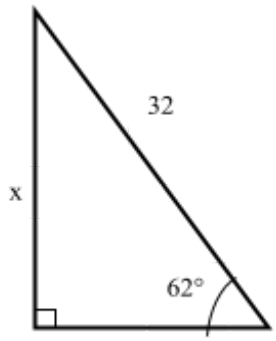
7. $(5x - 4)(x + 1) = 0$

8. $(4x + 7)(2x + 3) = -26$

9. $2x = \frac{6x}{5x^2 - 8}$

10. $2x^2 = 5x + 17$

11. 

12. 

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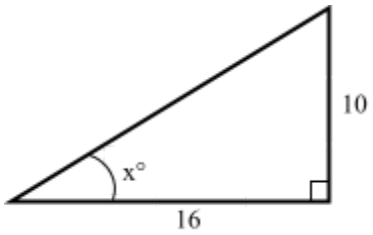

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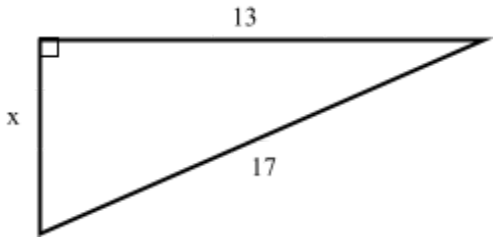

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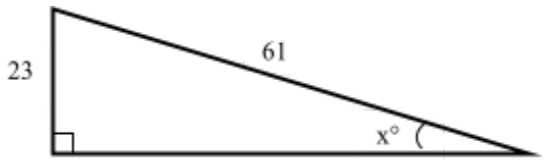

Solve the following system of equations for x and y

16. $y = 5x + 3$
    $y = 8x - 3$

17. $4x - 9y = 8$
    $9y + 3x = -15$

18. $3x = 8 - 12y$
    $-2y - 6x = 7$

19. $\frac{9}{x} + 6y = -2$
$x = 0.4y - 4$

Solve the following equations in terms of the given variable. Simplify as much as possible.

20. Solve for a: $ab + cd = e$

21. Solve for y: $\frac{xy}{z} = w$

22. Solve for p: $ft = \frac{g}{p^2} + s$

23. Solve for r: $w(r + y) = xr - t$

24. Solve for n: $an^2 = ng^2 + np$

The following are actual physics equations we will work with throughout the course. Solve each equation and express your answer in the correct units. Round each answer to 3 significant digits.

25. $K = \frac{1}{2}mv^2$

$K = \frac{1}{2} \cdot 210\ kg \cdot \left(10.5\ \frac{m}{s}\right)^2$ $K =$

26. $F = G\frac{m_1 m_2}{r^2}$

$F = \left(6.67x10^{-11}\ \frac{N \cdot m^2}{kg^2}\right) \bullet \frac{\left(5.64x10^{24}\ kg\right)\left(1.99x10^{31}\ kg\right)}{\left(1.51x10^{11}\ m\right)^2}$ $F =$

27. $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

$\frac{1}{R_p} = \frac{1}{24\ \Omega} + \frac{1}{18\Omega}$ $R_p =$

28. $\tau = rF\sin(\theta)$

$\tau = 1.4\ m \cdot 28\ N \cdot \sin 47°$ $\tau =$

29. $T = 2\pi\sqrt{\frac{l}{g}}$

$T = 2\pi\sqrt{\frac{0.344\ m}{9.8\ \frac{m}{s^2}}}$ $T =$

Solve the following physics equations for the variable indicated.

30. $K = \frac{1}{2}kx^2$ $x =$

31. $T_p = 2\pi\sqrt{\frac{l}{g}}$ $g =$

32. $F_g = G\frac{m_1 m_2}{r^2}$ $r =$

33. $mgh_0 = \frac{1}{2}mv_f^2$ $v_f =$

34. $pV = nRT$ $T =$

35. $W = Fd\cos\theta$ $\theta =$

36. $v_f^2 = v_0^2 - 2a\left(x_f - x_0\right)$ $x_0 =$

37. $x_f = x_0 + v_0 t + \frac{1}{2}at^2$ $t =$

38. $a_c = \frac{v^2}{r}$ $v =$

39. $F = k\frac{q_1 q_2}{r^2}$ $q_2 =$

40. $Ft = mv_f - mv_0$ $v_f =$

Combine the following equations into one equation. Then, solve for the variable indicated. Your answer must only include the variables shown in parentheses but may include any constants.

41. $K = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$ $\qquad K\,(m,\ v)\ =$

$I = mr^2$

$v = r\omega$

42. $v_f = v_0 + at$ $\qquad F\,(v_0,\ v_f,\ m,\ t) =$

$F = ma$

43. $a = G\frac{M}{r^2}$ $\qquad v\,(G,\ M,\ r)\ =$

$a = \frac{v^2}{r}$

44. $T = 2\pi\sqrt{\frac{m}{k}}$ $\qquad L\,(T,\ g)\ =$

$F = kL$

$F = mg$