

Name: _____

Date: _____

AP Physics 1: Summer Assignment

“Education is not the learning of facts, but the training of the mind to think.” – Albert Einstein

The beginning assignments come from material that you should have previously learned from your past math classes. These topics will be essential for your success in Physics and you will be lost without a solid foundation of the following topics. If for any reason you are struggling with the material it is your responsibility to gain a better understanding of it through: Khan academy, YouTube, Tutor, or Textbook.

Physics is unlike any subject you have taken before and it will constantly test not what you memorized, but your ability to apply the knowledge you gained.

Website and Channels that can help you relearn this material:

<https://www.khanacademy.org/>

<https://www.youtube.com/@misterwootube>

Summer Assignment Instructions and Summary

Complete all of the problems, showing all of your work neatly on a separate sheet of paper.

Assigned Problems

1. Trigonometry Problems (1-9)
2. Dimensional Analysis Problems (10-14)
3. Formula Derivations and Algebra (15-31)
4. Introduction to 1D Kinematics
 - a. Uniform Motion (Constant Velocity) Worksheet (1-10)
 - b. Graphs of Motion 1 Worksheet (1-8)
 - c. Uniform Accelerated Motion Worksheet (1- 20)

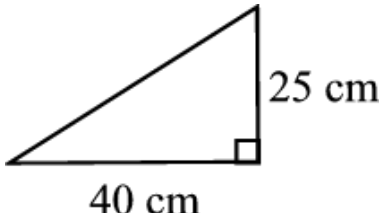
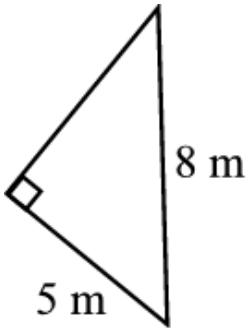
When you have finished, upload your work to google classroom before the 1st day of school. You will be added to your class period's google classroom page by your teacher at the end of August.

Review Topic 1: Trigonometry

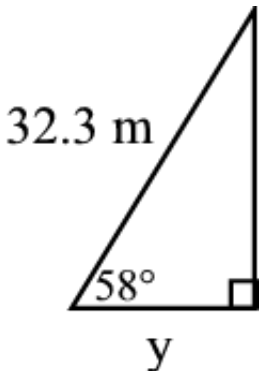
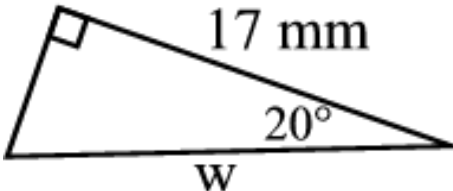
Answer the following questions using Pythagorean theorem, trigonometric functions and inverse trigonometric functions.

Watch the video if needed: [A Problem to Review SOH CAH TOA and the Pythagorean Theorem](#)

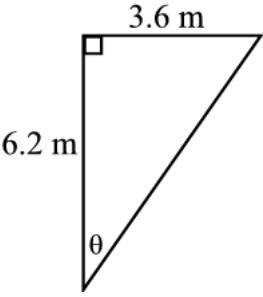
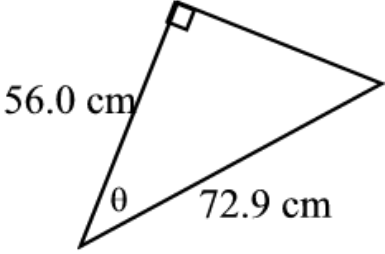
1. Fill in the missing side of each triangle.

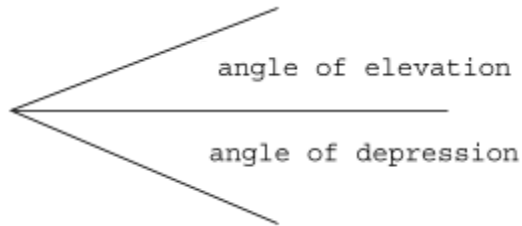
a)		b)	
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2. Find the marked side of each triangle.

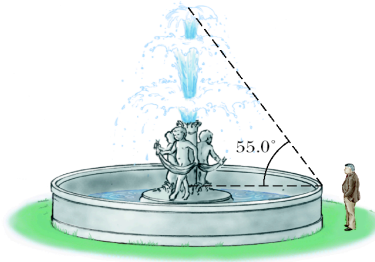
a)		b)	
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3. Find the value for the marked angle

a)		b)	
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4. From the top of a lookout tower, the angle of depression of a small fire is 7.2° . If the height of the tower is 33 m, how far from the base of the tower is the fire?
5. A tourist is standing 150.0 m from the base of a tall building. If the angle of elevation is 40.0° , how tall is the building?
6. A person flying a kite has let out 75 m of string. The angle of elevation of the kite is 51° . What is the height of the kite above the ground?



7. A high fountain of water is located at the center of a circular pool as shown above. Not wishing to get his feet wet, a student walks around the pool and measures its circumference to be 15.0 m. Next, the student stands at the edge of the pool and uses a protractor to gauge the angle of elevation at the bottom of the fountain to be 55.0° . How high is the fountain?
8. The horizontal distance between two buildings is 150 m. A stationary observer is located at a window in the 1st building and measures the angle of elevation to the top of the second building is 29.2° and the angle of depression to the base of the second building is 12.6° . Compute the height of the second building.
9. An observer on a balloon is 250 m above the ground near a river. The observer measures the angles of depression to points on the near and far banks of 42° and 36° respectively. When looking from a top (or bird's eye) view, the balloon, near bank and far bank are in a straight line and in this order. The line of sight for the observer is perpendicular to the river that runs North to South.
 - a. What is the horizontal distance from the near river bank to the point directly below the balloon?
 - b. What is the width of the river?

Review Topic 2: Dimensional Analysis

Also known as the **factor-label method** or **unit-factor method**, dimensional analysis is a structured, mathematical approach to converting measurements from one unit to another.

Instead of trying to remember whether you need to multiply or divide by a certain number, dimensional analysis treats units like algebraic variables. If a unit appears in both the numerator (top) and the denominator (bottom) of a fraction, they cancel each other out.

The core tool of dimensional analysis is the **conversion factor**. A conversion factor is a fraction that expresses the relationship between two different units that equal the same amount.

Because the top and the bottom represent the exact same quantity, the value of the fraction is technically equal to 1. Multiplying a measurement by 1 doesn't change its actual physical size—it just changes the "jacket" (the unit) it's wearing.

To convert any unit, you set up a grid or a string of multiplications:

1. **Start with your given measurement** (the value you want to change).
2. **Choose a conversion factor** that places the unit you want to *get rid of* on the opposite side of the fraction (if the given unit is on top, put that unit on the bottom of the conversion factor).
3. **Cancel the units and multiply across.**

If needed watch this: [Treating Units Algebraically and Dimensional Analysis](#)

Complete the following dimensional analysis questions, showing all of your work on a separate sheet of paper.

10. Although it is widely believed that Germany's Autobahn highway has no speed limit whatsoever, much of the highway has regulated speed limits of 130 km/hr or less, and in some places speed is limited to just 60 km/hr.
 - a. How many miles per hour is 130 km/hr? (1 mile = 1.61 km)
 - b. How many miles per hour is 60 km/hr?
11. If you are traveling at 65 miles per hour, how many feet will you be traveling in one second? (1 mile = 5280 feet)
12. The speed of light is 3×10^8 meters/second. What is the speed of light in miles/year? (1609 meters = 1 mile)
13. What is 130 meters per second into kilometers per hour?
14. The density of Aluminum is 2.7 grams per centimeter cubed (g/cm^3). What is the density of aluminum in kilograms per meter cubed (kg/m^3)?

Review Topic 3: Formula Derivations and Algebra

In physics, solving algebraically (instead of plugging in numbers right away) will have many advantages in your future in physics!

- a) Your answers will be more accurate due to fewer rounding errors.
- b) You won't need to redo your math if asked a follow up question where something changes.
- c) You will be able to quickly determine the shapes of graphs.
- d) You will better understand the relationships between different factors in a situation.

We'll start out with "simple" formulas that are already given. Using these formulas, solve (or isolate) these equations for x . In other words, rearrange the variables to create a new formula where x = everything else. Final equations should be simplified if able.

15.	$a + 3x = y + z$	16.	$\frac{x}{a} = 1 + \frac{y}{b}$
17.	$y = \frac{x+a}{x-a}$	18.	$\sqrt{x} - 3 = y$
19.	$a + \frac{1}{x} = y + z$	20.	$\frac{x+y}{y} = \frac{y}{a} + \frac{a}{y}$

Now you will have to use real Physics formulas and variables. Don't worry about making sense of the meaning of the formulas. Keep track of variables that are allowed in the final formula.

21. Solve this equation for t in terms of v , v_0 , and a . (Note: v_0 is a variable "vee - zero" or "vee - naught", and not v times zero.)

$$v = v_0 + at$$

22. Solve this equation for a in terms of v and d if $v_0 = 0$.

$$v^2 = v_0^2 + 2ad$$

23. Solve this equation for t in terms of a and d if $v_0 = 0$.

$$d = v_0 t + \frac{1}{2}at^2$$

24. Solve the left equation for v , then use your answer to rewrite K only in terms of p and m .

$p = mv$	$K = \frac{1}{2}mv^2$
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25. Suppose we know $U_s = U_g$, solve for x in terms of k , m , g , & h (this means you may not have all of them in your answer, but you can't have anything else. Note: U_s and U_g are single variables with subscripts.)

$U_s = \frac{1}{2}kx^2$	$U_g = mgh$
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26. The following 3 equations are true for a certain situation. Write an equation for a only in terms of m , x , g , and k .

$F_g = mg$	$F_s = kx$	$F_s - F_g = ma$
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27. The following 4 equations are true for a certain situation. Assuming $v_0 = 0$, write an equation for K in terms of m , g , and t .

$F_g = mg$	$F_g = ma$	$K = \frac{1}{2}mv^2$	$v = v_0 + at$
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28. The following 3 equations are true for a certain situation. Write an equation for d only in terms of m , g , and h .

$mgh = \frac{1}{2}mv^2$	$h = \frac{1}{2}gt^2$	$d = vt$
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29. The following 4 equations are true for a certain situation. Write an equation for a only in terms of μ , m , g (this means you may not have all of them in your answer, but you can't have anything else). Note: F_g , F_N , and F_f are all single variables with subscripts, not multiplied variables.

$F_g = mg$	$F_f = \mu F_N$	$F_g = F_N$	$F_f = ma$
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30. For a different situation, the following 5 equations are true. Write an equation for v only in terms of μ , m , g , and r .

$F_g = mg$	$F_f = F_g$	$F_f = \mu F_N$	$F_N = ma$	$a = v^2/r$
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31. For a different situation, the following 3 equations are true. Assuming that $a = 0$, write an equation for θ only in terms of μ , m , g . Recall that $\tan(\theta) = \sin(\theta)/\cos(\theta)$.

$F_N = mg \cos(\theta)$	$F_f = \mu F_N$	$mg \sin(\theta) - F_f = ma$
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Topic 4: Introduction to 1D Kinematics

AP Physics is a rigorous and fast paced course. In order to cover all of the content in the course, the final portion of the summer assignment is to learn Linear (or 1D) Kinematics. This topic is the foundation of Physics and the starting point for this course. You will have seen a lot of this in Physical Science. We will review these topics at the beginning of the school year. **Expect a test on this topic within the first 2 weeks of school.**

1. Read through the [Notes on 1D Kinematics](#). Example problems are provided with solutions.
2. Complete the following sets of practice problems
 - a. [Uniform Motion \(Constant Velocity\)](#)
 - b. [Graphs of Motion 1](#)
 - c. [Uniform Accelerated Motion](#)
3. If extra reinforcement is needed, use the Physics Classroom Tutorial [1 - D Kinematics](#) or Flipping Physics [One Dimensional Motion](#) videos.