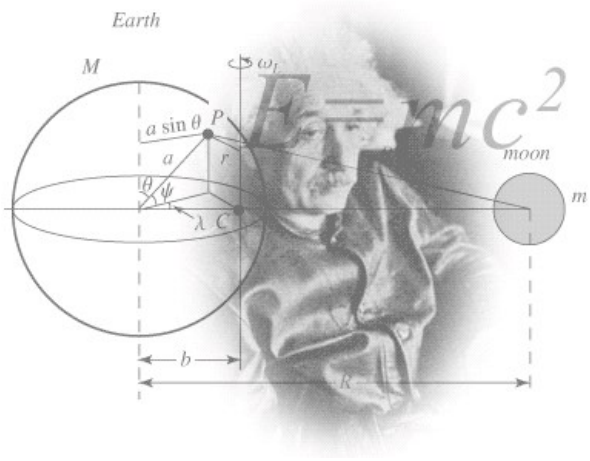
AP Physics 1 Summer Assignment



Welcome to AP Physics 1! This is a college level physics course that is fun, interesting, and challenging on a level you've not yet experienced. This assignment will review all of the prerequisite knowledge expected of you. There are 5 parts to this assignment. It is the quantity, not the difficulty of the problems that has the potential to overwhelm, so do it over an extended period of time. By taking the time to review and understand all parts of this assignment, you will help yourself acclimate to the rigor and pacing of AP Physics 1. It is VERY important that this assignment be completed ***individually***. It will be a total waste of your time to copy the assignment from a friend. The summer assignment will be due the first day of class. Good luck!

Before you get started- email me at heyesd@calvertnet.k12.md.us and introduce yourself. Tell me how your summer is going and why you are interested in taking AP Physics 1. I'll email you back the code for joining the class remind page, which you should do prior to the 1st day of class.

Part 1: Scientific Notation and Dimensional Analysis (Expected time for completion: 0.5 hr)

Many numbers in physics will be provided in scientific notation. You need to be able read and simplify scientific notation. (**This section is to be completed *without* calculators…all work should be done by hand.)** Get used to no calculator! All multiple choice portions of tests will be completed without a calculator.

Express the following the numbers in scientific notation. Keep the same unit as provided. ALL answers in physics need their appropriate unit to be correct.

1. 7,640,000 kg
2. 8327.2 s
3. 0.000000003 m
4. 4. 0.0093 km/s

Often times multiple numbers in a problem contain scientific notation and will need to be reduced by hand. Before you practice this, remember the **rules for exponents** you learned in algebra:

When numbers with exponents are multiplied together, you _____ the exponents and _____ the bases.

When numbers are divided, you _____ the exponents and _____ the bases.

When an exponent is raised to another exponent, you _____ the exponents and _____ the base.

Using the three rules from above, simplify the following numbers in proper scientific notation:

5. $(3x10^{6})\cdot(2x10^{4})$ =

6. $(1.2x10^{4}) / (6x10^{-2})$ =

7. $(4x10^{8})\cdot(5x10^{-3})$ =

8. $(7x10^{3})^{2}$ =

9. $(8x10^{3}) / (2x10^{5})$ =

10. $(2x10^{-3})^{3}$ =

Fill in the power and the symbol for the following unit prefixes. Look them up as necessary. These should be **memorized** for next year. Kilo- has been completed as an example.

Prefix	Power	Symbol
Giga-		
Mega-		
Kilo-	10^{3}	k
Centi-		
Milli-		
Micro-		
Pico-		

Not only is it important to know what the prefixes mean, it is also vital that you can convert between metric units. If there is no prefix in front of a unit, it is the base unit which has 10^{0} for its power, or just simply "1". Remember if there is an exponent on the original unit, the converted unit should be raised to the same exponent.

Convert the following numbers into the specified unit. Use scientific notation when appropriate.

1. 24 g = _____ kg
2. 94.1 MHz = _____ Hz
3. 6 Gb = _____ kb
4. 640 nm = _____ m
5. 3.2 m^2 = _____ cm^2
6. 40 mm^3 = _____ m^3
7. 1 g/cm^3 = _____ kg/m^3
8. 20 m/s = _____ km/hr

For the remaining scientific notation problems you may use your calculator. It is important that you know how to use your calculator for scientific notation. The easiest method is to use the "EE" button. An example is included below to show you how to use the "EE" button.

Ex: 7.8×10^{-6} would be entered as 7.8 E -6

9. $(3.67 \times 10^{3})(8.91 \times 10^{-6}) =$

10. $(5.32 \times 10^{-2})(4.87 \times 10^{-4}) =$

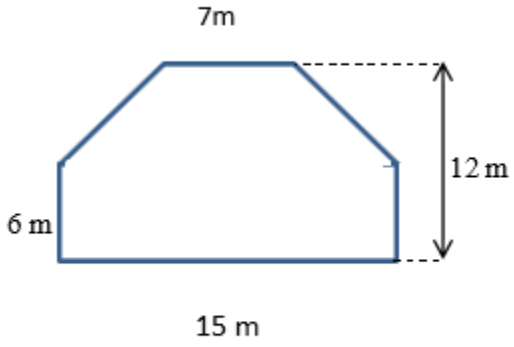
11. $(9.2 \times 10^{6}) / (3.6 \times 10^{12}) =$

12. $(6.12 \times 10^{-3})^{3} =$

Part 2: Geometry (Expected time for completion: 0.5 hr)

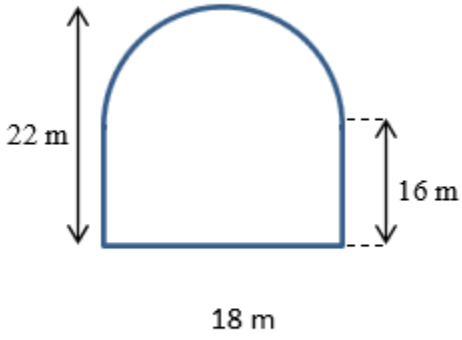
Calculate the area of the following shapes. It may be necessary to break up the figure into common shapes.

1.



Area = _____

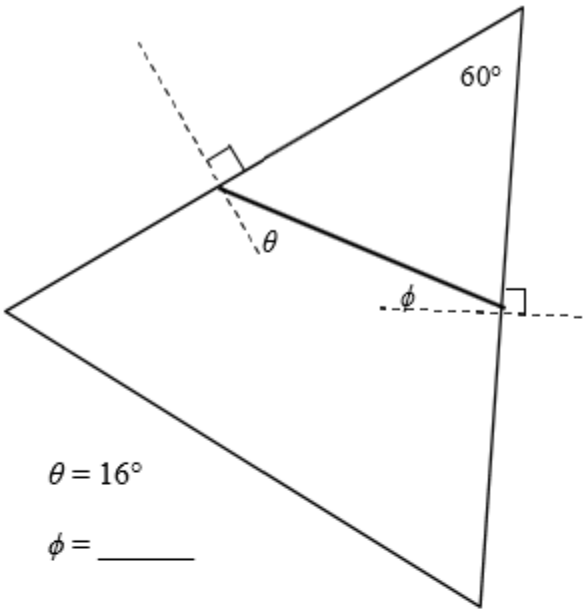
2.



Area = _____

Calculate the unknown angle values for questions 3-6.

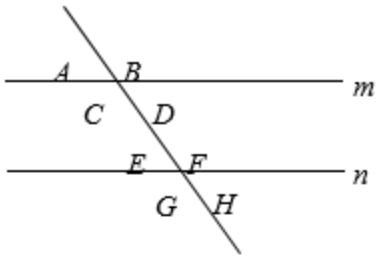
3.



$\theta = 16°$

$\phi =$ _____

4.

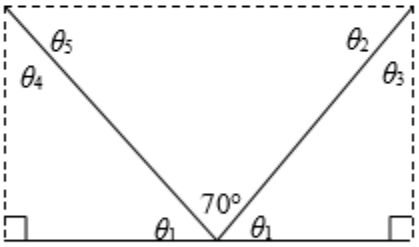


Lines m and n are parallel.

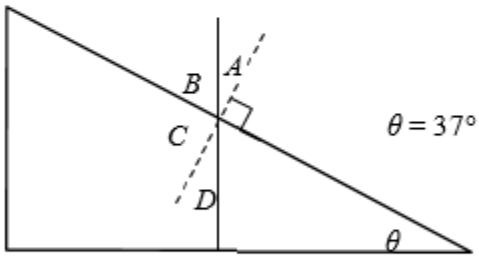
$A = 75°$ $B =$ _____ $C =$ _____ $D =$ _____

$E =$ _____ $F =$ _____ $G =$ _____ $H =$ _____

5.



6.



θ_1=_____ θ_2= _____ A= _____ B= _____

θ_3=_____ θ_4= _____ C= _____ D= _____

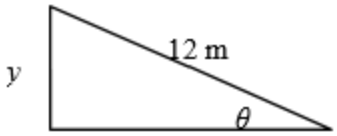
θ_5=_____

Part 3: Trigonometry (Expected time for completion: 0.5 hr)

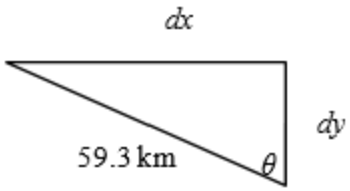
Write the formulas for each one of the following trigonometric functions. Remember SOHCAHTOA!

$\sin\vartheta =$ $\cos\vartheta =$ $\tan\vartheta =$

Calculate the following unknowns using trigonometry. Use a calculator, but show all of your work. Please include appropriate units with all answers. (Watch the unit prefixes!)



1.



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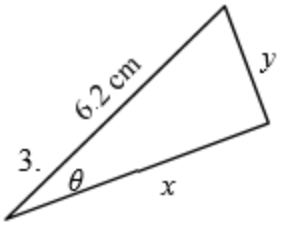


$\theta = 17°$

$y =$ _____

$x =$ _____

$\theta = 60°$

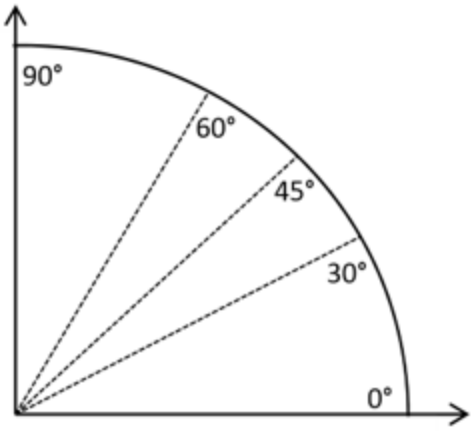
$d_x =$ _____

$d_y =$ _____

$\theta = 20°$

$x =$ _____

$y =$ _____



Refer to your completed chart to answer the following questions.

10. At what angle is sine at a maximum?

11. At what angle is sine at a minimum?

12. At what angle is cosine at a minimum?

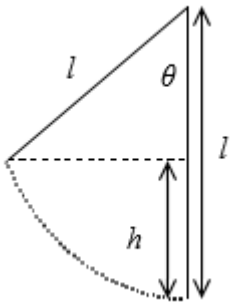
13. At what angle is cosine at a maximum?

14. At what angle are the sine and cosine equivalent?

15. As the angle increases in the first quadrant, what happens to the cosine of the angle?

16. As the angle increases in the first quadrant, what happens to the sine of the angle?

Use the figure at right to answer problems 17 and 18.



17. Find an expression for h in terms of l and ϑ.

18. What is the value of h if l = 6 m and ϑ = 40°?

Part 4: Algebra (Expected time for completion: 2.0 hr)

Solve the following on a separate piece of paper (almost all of these are easy – it is *important* for you to work *independently*). Units on the numbers are included because they are essential to the concepts, however they do not have any *effect* on the actual numbers you are putting into the equations. In other words, the units do not change how you do the algebra. ***Show every step for every problem***, including writing the original equation, all algebraic manipulations, and substitution! You should practice doing all algebra *before* substituting numbers in for variables.

Section I: *For problems 1-5, use the three equations below:*

$$v_f = v_0 + at$$

$$x_f = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$v_f^2 = v_o^2 + 2a(x_f - x_o)$$

1. Using the first equation solve for t given that v_0 = 5 m/s, v_f = 25 m/s, and a = 10 m/s^2.

2. Given v_0 = 0 m/s, x_0 = 0 m, v_f=25 m/s and t = 10 s, use the second and third equations together to find x_f.

3. a = 10 m/s^2, x_0 = 0 m, x_f = 120 m, and v_0 = 20 m/s. Use the second equation to find t.

4. v_f = - v_0 and a = 2 m/s^2. Use the first equation to find t / 2.

5. How does each equation simplify when a = 0 m/s^2 and x_0 = 0 m?

Section II: *For problems 6 – 9, use the four equations below.*

$$\sum F = ma$$
$$f_k = \mu_k N$$
$$f_s \leq \mu_s N$$
$$F_s = -kx$$

6. If ΣF = 10 N and a = 1 m/s^2, find m using the first equation.

7. Given ΣF = f_k, m = 250 kg, μ_k= 0.2, and N = 10N, find *a.*

8. ΣF = T – 10m, but a = 0 m/s^2. Use the first equation to find m in terms of T.

9. Given the following values, determine if the third equation is valid. ΣF = f_s, m = 90 kg, and a = 2 m/s^2. Also, μ_s = 0.1, and N = 5 N.

10. Use the first equation in Section I, the first equation in Section II and the givens below, find ΣF . m = 12 kg, v_0 = 15 m/s, v_f = 5 m/s, and t = 12 s.

11. Use the last equation to solve for F_s if k = 900 N/m and x = 0.15 m.

Section III: *For problems 12, 13, and 14 use the two equations below.*

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

$$\tau = rF\sin\Theta$$

12. Given that v is 5 m/s and r is 2 meters, find *a.*

13. Originally, a = 12 m/s^2, then r is doubled. Find the new value for a.

14. Use the second equation to find ϑ when τ = 4 Nm, r = 2 m, and F = 10 N.

***Section IV**: For problems 15 – 23, use the equations below.*

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

$$\Delta U_g = mgh$$

$$W = F(\Delta x)cos\Theta$$

$$U_s = \frac{1}{2}kx^2$$

$$P = \frac{W}{t}$$

$$P = Fv_{avg}cos\Theta$$

15. Use the first equation to solve for K if m = 12 kg and v = 2 m/s.

16. If ΔU_g = 10 J, m = 10 kg, and g = 9.8 m/s^2, find h using the second equation.

17. $K = \Delta U_g$, g = 9.8 m/s^2, and h = 10 m. Find v.

18. The third equation can be used to find W if you know that F is 10 N, Δx is 12 m, and ϑ is 180°.

19. Use the value for W you found in the previous question to find P if t = 2 s. Which equation do you need?

20. Given U_s = 12 joules, and x = 0.5 m, find k using the fourth equation.

21. For the same value of x as given in problem 20 and the k value you just found, use the last equation in Section II to find F_s.

22. Assuming ϑ = 0° and $F = F_s$, use the third equation listed above along with the numbers found and given in the previous two questions to find W.

23. For P = 2100 W, F = 30 N, and ϑ = 0°, find v_{avg} using the last equation in this section.

Section V: *For problems 24 – 26, use the equations below.*

$$p = mv$$

$$J = F\Delta t = \Delta p$$

$$\Delta p = m\Delta v$$

24. p is 12 kgm/s and m is 25 kg. Find v using the first equation.

25. "Δ" means "final state minus initial state". So, Δv means $v_f - v_i$ and Δp means $p_f - p_i$. Find v_f using the third equation if p_f = 50 kgm/s, m = 12 kg, and v_i and p_i are both zero.

26. Use the second and third equation together to find v_i if v_f = 0 m/s, m = 95 kg, F = 6000 N, and Δt = 0.2 s.

Section VI*: For problems 27 – 29 use the three equations below.*

$$T_s = 2\Pi\sqrt{\frac{m}{k}}$$

$$T_p = 2\Pi\sqrt{\frac{l}{g}}$$

$$T = \frac{1}{f}$$

27. T_p is 1 second and g is 9.8 m/s^2. Find l using the second equation.

28. m = 8 kg and T_s = 0.75 s. Solve for k.

29. Given that $T_p = T$, g = 9.8 m/s^2, and that l = 2 m, find f (the units for f are Hertz).

GOOD JOB! That wasn't so bad was it? *Trust me*… the time it took to get through all of those problems will make everything later on a lot easier. Think about it as an investment with a guaranteed return.

Part 5: Scalars and Vectors (Expected time for completion: 1.5 hr)

Hooray for the Internet! Watch the following two videos:

http://www.khanacademy.org/science/physics/v/introduction-to-vectors-and-scalars

http://www.khanacademy.org/science/physics/v/visualizing-vectors-in-2-dimensions

For each video, summarize the content Mr. Khan is presenting in three sentences. Then, write at least one question per video on something you didn't understand or on a possible extension of the elementary concepts he presents here. ***Email (heyesd@calvertnet.k12.md.us) or share your document with me using the filename summerassignmentlastnamefirstinitial (using your last name and first initial).***

If you have issues paying attention or if your Facebook is open as you are trying to focus on these videos, you might have to watch them more than once. Trust me, these concepts are some of the *building blocks* of Physics. Get this down and you are on the fast track to success.

This course is a wonderful opportunity to grow as a critical thinker, problem solver and great communicator. It is not *impossibly hard. It* ***does*** *require hard work, but so does anything that is worthwhile. You would never expect to win a race if you didn't train. Similarly, you can't expect to do well in school if you don't train academically. AP Physics is immensely rewarding and exciting, but you do have to take notes, study, and read the book (gasp!). I guarantee that if you do what is asked of you that you will look back to this class with a huge sense of satisfaction! I know I can't wait to get started… Let's learn some* ***SCIENCE****!!!*