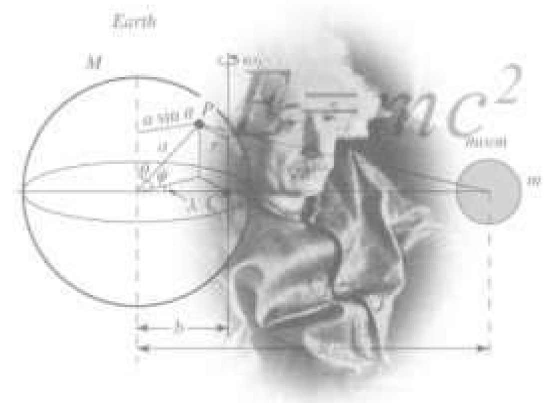
AP Physics 1 Summer Assignment



Welcome to AP Physics 1! It is a college level physics course that is fun, interesting and challenging on a level you've not yet experienced. This summer assignment will review all of the prerequisite knowledge expected of you. There are 5 parts to this assignment. It is quantity not the difficulty of the problems that has the potential to overwhelm, so do it over an extended period of time. it should not take you any longer than a summer reading book assignment. 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. Use the book if you need to, but really this is all stuff you already know how to do (basic math skills). 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! ☺

Part 1: Scientific Notation and Dimensional Analysis

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. 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, remember the rules for exponents.

When numbers are multiplied together, you *(add / subtract)* the exponents and *(multiply / divide)* the bases.

When numbers are divided, you *(add / subtract)* the exponents and *(multiply / divide)* the bases.

When an exponent is raised to another exponent, you *(add / subtract / multiply / divide)* the exponent.

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-		
Nano-		
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 unit, the conversion should be raised to the same exponent as well.

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.

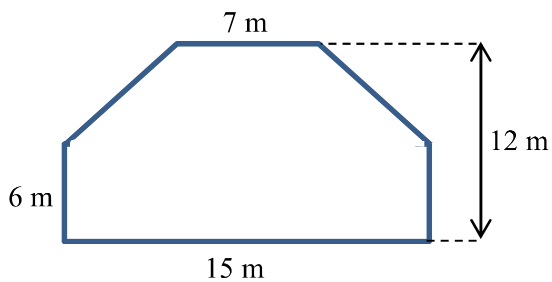
Ex: $7.8x10^{-6}$ would be entered as 7.8"EE"-6

9. $(3.67x10^{3})(8.91x10^{-6})$ =
10. $(5.32x10^{-2})(4.87x10^{-4})$ =
11. $(9.2x10^{6})$ / $(3.6x10^{12})$ =
12. $(6.12x10^{-3})^3$

Part 2: Geometry

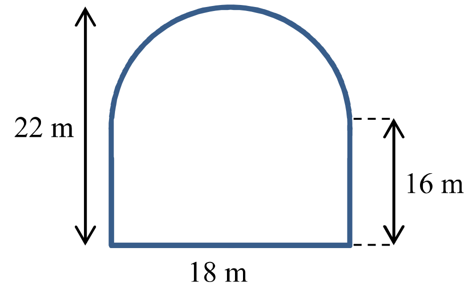
Calculate the area of the following shapes. It may be necessary to break up the figure into common shapes.

1.



Area = _________

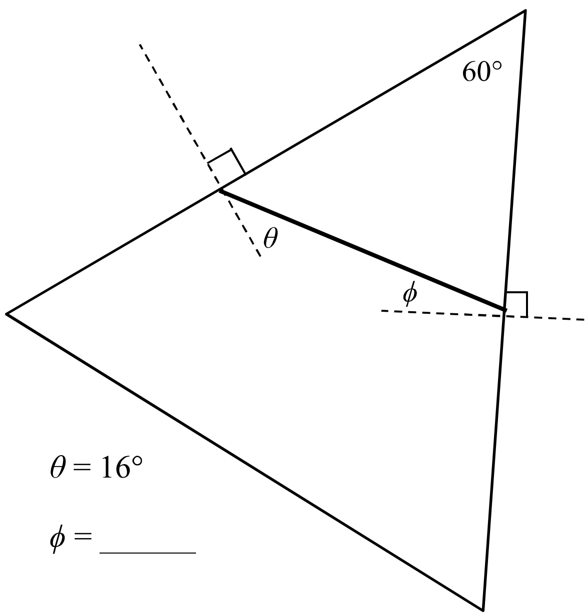
2.



Area = _________

Calculate the unknown angle values for questions 3-6.

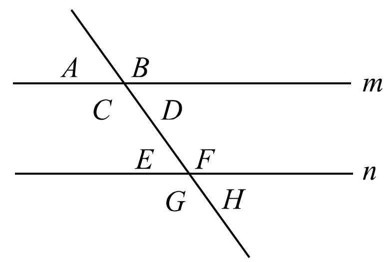
3.



$\theta = 16°$

$\phi =$ _______

4.

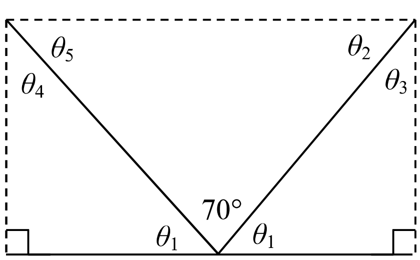


Lines m and n are parallel.

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

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

5.



$\theta_1 =$ _____

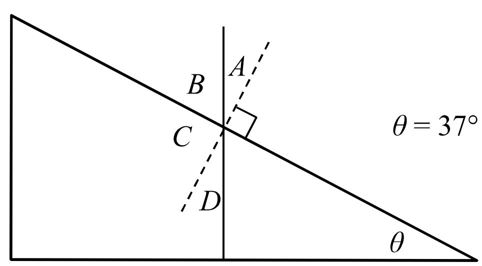
$\theta_2 =$ _____

$\theta_3 =$ _____

$\theta_4 =$ _____

$\theta_5 =$ _____

6.



$\theta = 37°$

$A =$ _____ $B =$ _____

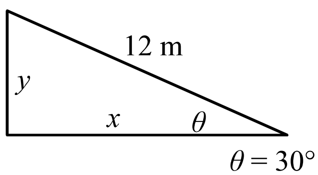
$C =$ _____ $D =$ _____

Part 4: Trigonometry

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

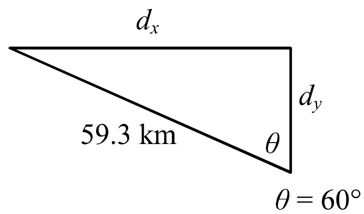
$\sin\theta =$ $\qquad\qquad$ $\cos\theta =$ $\qquad\qquad$ $\tan\theta =$

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.


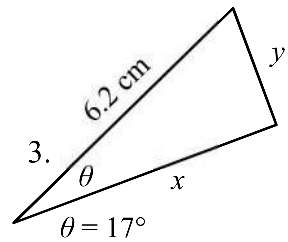
$y =$ ________

$x =$ ________

2.


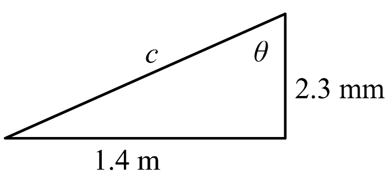
$d_x =$ _______

$d_y =$ _______

3.


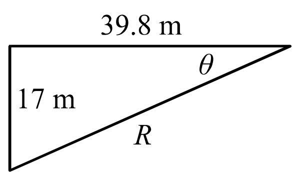
$x =$ ______

$y =$ ______

4.


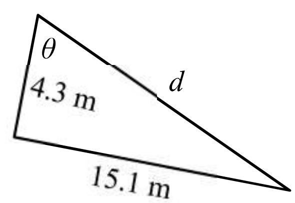
$c =$ _______

$\theta =$ _______

5.


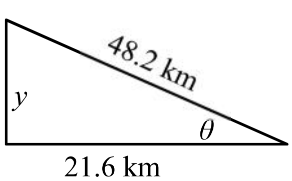
$R =$ _______

$\theta =$ _______

6.


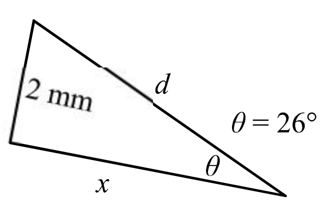
$d =$ _______

$\theta =$ _______

7.


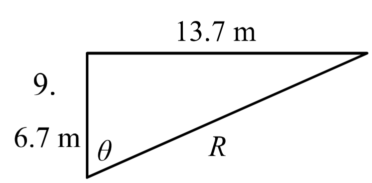
$y =$ _______

$\theta =$ _______

8.


$x =$ _______

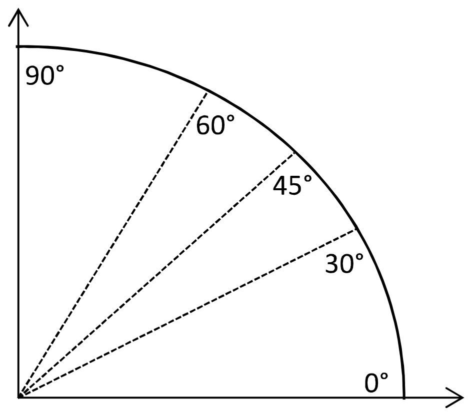
$d =$ _______

9.


$R =$ _______

$\theta =$ _______

You will need to be familiar with trigonometric values for a few common angles. Memorizing this unit circle diagram in degrees or the chart below will be very beneficial for next year in both physics and pre-calculus. How the diagram works is the cosine of the angle is the x-coordinate and the sine of the angle is the y-coordinate for the ordered pair. Write the ordered pair (in fraction form) for each of the angles shown in the table below



θ	$\cos\theta$	$\sin\theta$
0°		
30°		
45°		
60°		
90°		

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?

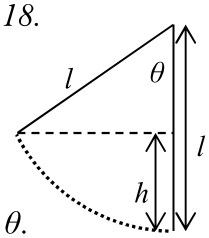
13. At what angle is cosine at a maximum?

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 below 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 $\theta = 40°$?

Part 5: Algebra

Solve the following (almost all of these are extremely **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:*

$$v_f = v_0 + at \qquad x_f = x_0 + v_0 t + \frac{1}{2}at^2 \qquad v_f^2 = v_0^2 + 2a(x_f - x_0)$$

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

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

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

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

Section II: *For problems 6 – 11, use the four equations below.*

$$\Sigma F = ma \qquad f_s \le \mu_s N$$
$$f_k = \mu_k N \qquad F_s = -kx$$

5. If $\Sigma F = 10$ N and $a = 1$ m/s^2, find m using the first equation.

6. Given $\Sigma F = f_k$, $m = 250$ kg, $\mu_k = 0.2$, and $N = 10m$, find a.

7. $\Sigma F = T - 10m$, but $a = 0$ m/s^2. Use the first equation to find m in terms of T.

8. Given the following values, determine if the third equation is valid. $\Sigma F = f_s$, $m = 90$ kg, and $a = 2$ m/s^2. Also, $\mu_s = 0.1$, and $N = 5$ N.

9. 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.

10. 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.*

$$a = \frac{v^2}{r} \qquad \tau = rFsin\theta$$

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

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

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

Section IV*: For problems 15 – 22, use the equations below.*

$$K = \frac{1}{2}mv^2 \qquad W = F(\Delta x)cos\theta \qquad P = \frac{W}{t}$$

$$\Delta U_g = mgh \qquad U_s = \frac{1}{2}kx^2 \qquad P = Fv_{avg}cos\theta$$

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

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

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

17. 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°.

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

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

Section V: *For problems 23 – 25, use the equations below.*

$$p = mv \qquad F\Delta t = \Delta p \qquad \Delta p = m\Delta v$$

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

21. "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.

22. 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 26 – 28 use the three equations below.*

$$T_s = 2\pi\sqrt{\frac{m}{k}} \qquad T_p = 2\pi\sqrt{\frac{l}{g}} \qquad T = \frac{1}{f}$$

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

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

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

Section VII*: For problems 29 – 32, use the equations below.*

$$F_g = -\frac{GMm}{r^2} \qquad U_g = -\frac{GMm}{r}$$

26. Find F_g if $G = 6.67 \times 10^{-11}$ m^3 kg^{-1} s^{-2}, $M = 2.6 \times 10^{23}$ kg, m = 1200 kg, and r = 2000 m.

27. What is r if U_g = -7200 J, $G = 6.67 \times 10^{-11}$ m^3 kg^{-1} s^{-2}, $M = 2.6 \times 10^{23}$ kg, and m = 1200 kg?

28. Use the first equation in Section IV for this problem. $K = -U_g$, $G = 6.67 \times 10^{-11}$ m^3 kg^{-1} s^{-2}, and $M = 3.2 \times 10^{23}$ kg. Find v in terms of r.

29. Using the first equation above, describe how F_g changes if r doubles.

Section VIII: *For problems 36 – 41 use the equations below.*

$$V = IR \qquad R = \frac{\rho l}{A}$$

$$I = \frac{\Delta Q}{t} \qquad R_S = (R_1 + R_2 + R_3 + \cdots + R_i) = \Sigma R_i$$

$$P = IV \qquad \frac{1}{R_P} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_i}\right) = \sum_i \frac{1}{R_i}$$

30. Given V = 220 volts, and I = 0.2 amps, find R (the units are ohms, Ω).

31. If ΔQ = 0.2 C, t = 1s, and R = 100 Ω, find V using the first two equations.

32. R = 60 Ω and I = 0.1 A. Use these values to find P using the first and third equations.

33. Let $R_S = R$. If R_1 = 50 Ω and R_2 = 25 Ω and I = 0.15 A, find V.

34. Let $R_P = R$. If R_1 = 50 Ω and R_2 = 25 Ω and I = 0.15 A, find V.

35. Given R = 110 Ω, l = 1.0 m, and $A = 22\times 10^{-6}$ m^2, find ρ.