Name_____

AP Physics 2 Summer Assignment

Welcome to AP Physics 2! I cannot wait to go through this exciting course with you. We have an exciting year ahead of us. A summer assignment is required for this course and will give you the opportunity to study all the material necessary for this course and review the important content.

Be sure to complete this assignment **individually**. Use a book or the internet if you need to, but really this is all stuff you already know how to do (basic math skills), or you can email me at abowman@bwschools.net if you are stuck or have a question [or message me on Remind!]. I'll get back to you as quickly as I can. It will be a total waste of your time to copy the assignment from a friend since you will not be prepared for this course.

This summer assignment is due on the **first day of school**.

Part I: Join Remind

Join our class on Remind by following the instructions below.

1. Go to https://www.remind.com/join
2. Enter the Class Code: apbowman23
3. Enter you first and last name along with your mobile phone number or email address. You can also sign-in/sign-up with Google.
4. Click Sign up.

You'll get notifications for AP Physics via the contact device you entered. I will send important reminders through Remind. I try to use as many ways to contact you as possible, but this is an easy way for me to communicate with all of you. It also allows you to "text" me for any important quick questions.

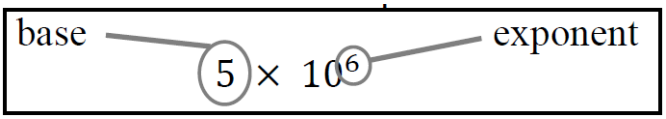
Part 2: Scientific Notation

Many numbers in physics will be provided in scientific notation. You need to be able to read and simplify scientific notation. (This section is to be completed without calculators…all work should be done by hand.)

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

1. 56,840,000 kg
2. 10,854.2 s
3. 0.0000007 m
4. 0.00093 $\frac{km}{s}$

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.



5. Circle the correct answers for each of the following questions (feel free to look them up!):
    a. When numbers are multiplied together, you (add / subtract) the exponents and (multiply / divide) the bases.
    b. When numbers are divided, you (add / subtract) the exponents and (multiply / divide) the bases.
    c. When an exponent is raised to another exponent, you (add / subtract / multiply / divide) the exponent

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

6. $(5 \times 10^5) \cdot (3 \times 10^3)$
7. $(4 \times 10^9) \cdot (5 \times 10^{-4})$

8. $(6 \times 10^{2}) \cdot (2 \times 10^{4})$

9. $\frac{(2\times10^{3})}{(6\times10^{6})}$

10. $\frac{(1.2\times10^{5})}{(6\times10^{-3})}$

11. $(7 \times 10^{5})^{4}$

12. $(2 \times 10^{-4})^{4}$

13. $(4 \times 10^{-5})^{-3}$

Part 3: Unit Prefixes and Dimensional Analysis

1. 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-		

Directions: Convert the following units from one to another. You must use dimensional analysis (also known as factor-label method). For example, You may be given the speed of an object as 25 km/h and wish to express it in m/s. To make this conversion, you must change km to m and h to s by multiplying by a series of factors so that the units you do not want will cancel out and the units you want will remain. Conversion factors: 1000 m = 1 km and 3600 seconds = 1 hour.

$$\left(\frac{25\ \text{km}}{\text{h}}\right)\left(\frac{1000\ \text{m}}{1\ \text{km}}\right)\left(\frac{1\ \text{h}}{3600\ \text{s}}\right) = 6.94\ \text{m/s}$$

2. How many seconds are in a year?

3. Convert 280 cm to m.

4. Convert 450 g to kg.

5. Convert 85 cm/min to m/s.

6. Convert 8.5 cm^3 to m^3.

Part 4: Solving Equations

Directions: Often problems on the AP exam are done with variables only. Below are various physics formulas. Don't worry about what the variables mean. Just solve for the variable indicated. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers.

a. $B = \frac{\mu_0 I}{2\pi r}$ $\quad r =$

b. $PV = nRT$ $\quad T =$

c. $x_m = \frac{m\lambda L}{d}$ $d =$

e. $sin\theta_c = \frac{n_1}{n_2}$ $\theta_c =$

d. $qV = \frac{1}{2}mv^2$ $v =$

f. $c = f\lambda$ $f =$

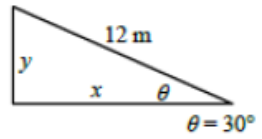
Part 5: Trigonometry

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

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

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!)

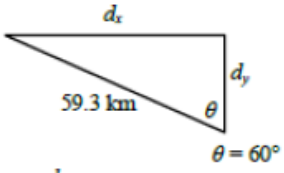
1.



$y =$ _____

$x =$ _____

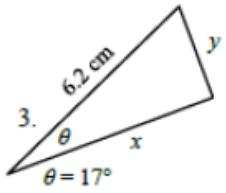
2.



$d_x =$ _____

$d_y =$ _____

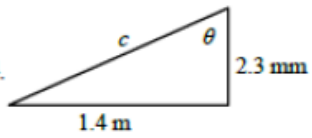
3.



$x =$ _____

$y =$ _____

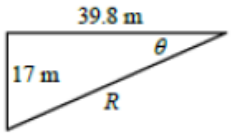
4.



$c =$ _____

$\theta =$ _____

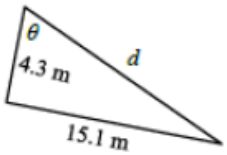
5.



$R =$ _____

$\theta =$ _____

6.

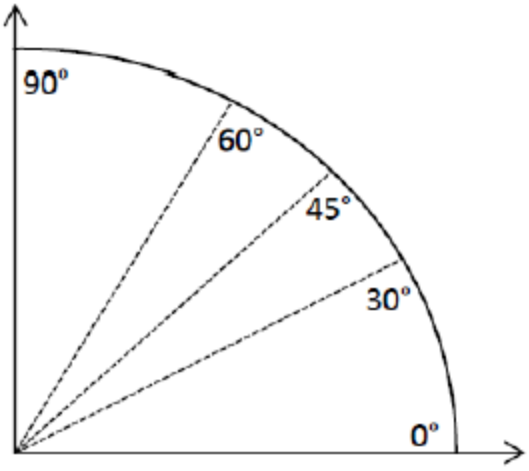


$d =$ _____

$\theta =$ _____

Directions: 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.

7. At what angle is sine at a maximum?

8. At what angle is sine at a minimum?

9. At what angle is cosine at a maximum?

10. At what angle is cosine at a minimum?

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

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

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

Part 6: Algebra

Directions: Solve the following (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!

1. Use the three equations below:

(1) $v_f = v_0 + at$ (2) $x_f = x_0 + v_0 t + \frac{1}{2}at^2$ (3) $v_f^{\,2} = v_0^{\,2} + 2a(x_f - x_0)$

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

   b. 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.

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

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

2. Use the 4 equations below.

(1)$\Sigma F = ma$ (2)$f_k = \mu_k N$ (3) $f_s \leq \mu_s N$ (4) $F_s = -kx$

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

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

c. ΣF = T – 10m, but a = 0 m/s2. Use the first equation to find m in terms of T.

d. 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.

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

3. Use the following 2 equations below.

(1) $a = \frac{v^2}{r}$ (2) $\tau = rFsin\theta$

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

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

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

Part 7: Graphing

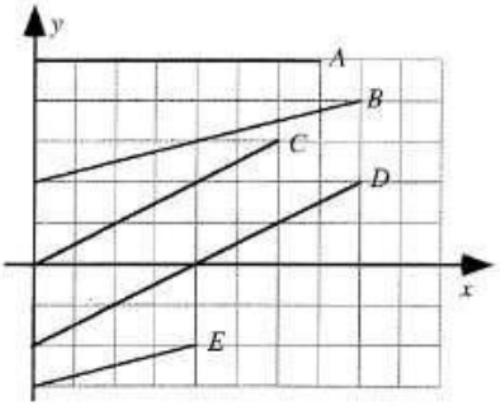
Below you will find a few example concept questions that review foundational knowledge of graphs. Ideally, you won't need to review, but you may need to review some math to complete these tasks.

Key Graphing Skills to Remember:

a. Always label your axes with appropriate units.
b. Sketching a graph calls for an estimated line or curve while plotting a graph requires individual data points AND a line or curve of best fit.
c. Provide a clear legend if multiple data sets are used to make your graph understandable.
d. Never include the origin as a data point unless it is provided as a data point.
e. Never connect the data points individually, but draw a single smooth line or curve of best fit
f. When calculating the slope of the best fit line you must use points from your line
g. You may only use given data points IF your line of best fit goes directly through them.

Questions:

1. Shown are several lines on a graph.

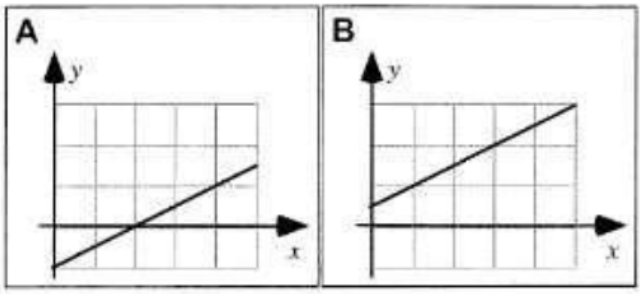


Rank the slopes of the lines in this graph.

					OR			
1 Greatest	2	3	4	5 Least		All the same	All zero	Cannot determine

Explain your reasoning.

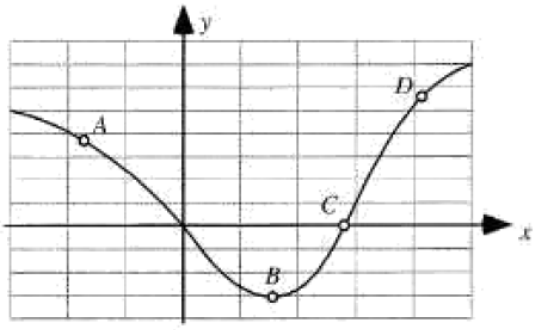
2. Shown are two graphs.



Is the slope of the graph (i) *greater in Case A*, (ii) *greater in Case B*, or (iii) *the same in both cases?* _____

Explain your reasoning.

3. Four points are labeled on a graph.



Rank the slopes of the graph at the labeled points.

				OR			
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

Part 8: Getting to Know You

Please answer the following questions

1. What was your favorite science subject: biology, chemistry, or physics? Why?

2. What science classes have you taken?

3. What math classes have you taken?

4. What are you most excited about in taking AP Physics 2?

5. What are you most scared about in taking AP Physics 2?

6. As of right now, are you planning on taking the AP Test for this course? (You can change your answer to this before the November sign-up deadline!)