AP Physics 1 & C Name: _____

Summer assignment for 2019-2020

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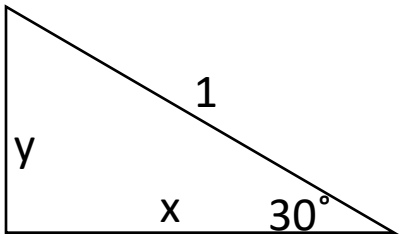
Part 1: Trigonometry Remember: SOHCAHTOA

First write the equations for sine, cosine, and tangent, then complete the following questions.

$\sin(\theta) =$ _____ $\cos(\theta) =$ _____ $\tan(\theta) =$ _____

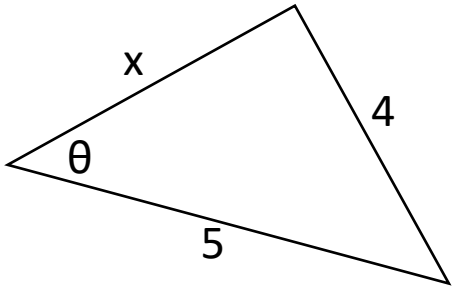
Find the numerical value(s) for the labeled side lengths and angles. Round to the nearest tenths place.

1.



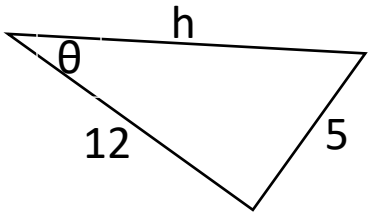
Y = X =

2.



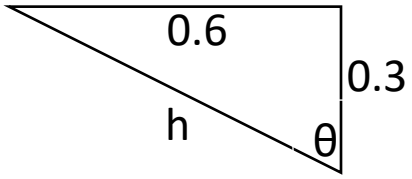
θ = x =

3.



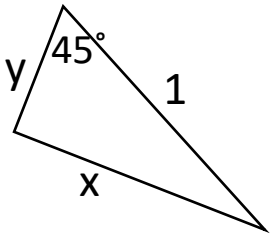
θ = h =

4.



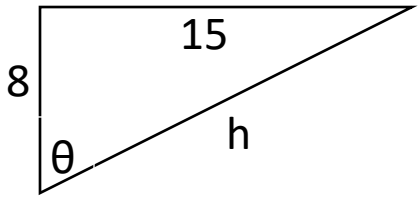
θ = h =

5.



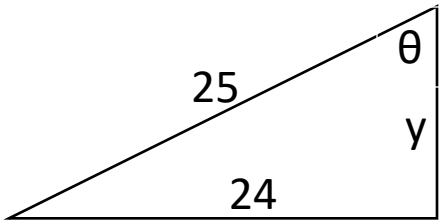
Y = x =

6.



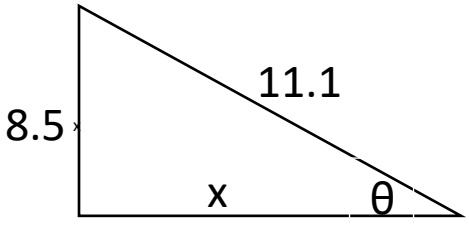
θ = h =

7.



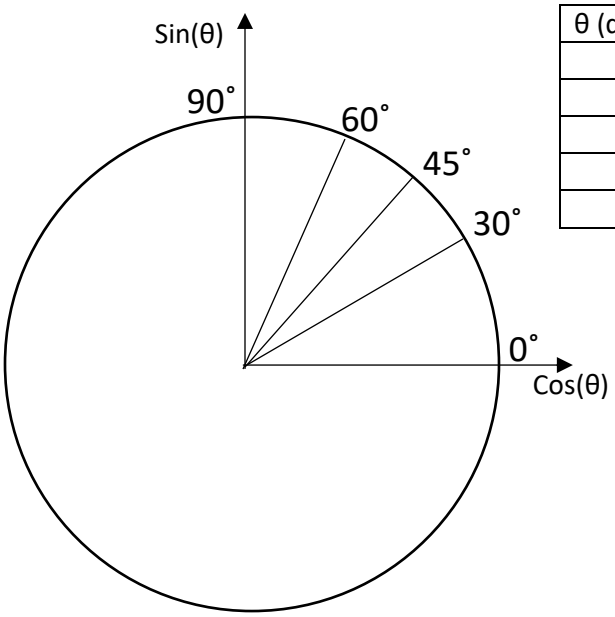
θ = y =

8.



θ = x =

9. Complete the table of the first quadrant of the unit circle. Then answer the following questions about the entire unit circle.



θ (degrees)	θ (radians)	Sin(θ)	Cos(θ)
0˚			
30˚			
45˚			
60˚			
90˚			

10. What angle(s) cause cosine to be at its maximum value?

11. What angle(s) cause sine to be at its maximum value?

12. What angle(s) cause cosine and sine to be equal values?

13. What angle(s) cause cosine to be at its minimum value?

14. What angle(s) cause sine to be at its minimum value?

For additional practice Khan Academy is a great resource. The trigonometry and precalculus units will greatly help in getting ready for the class.

Part 2: Unit conversion and Dimensional analysis

Familiarize yourself with the following tables, than complete the following questions.

1. The following table shows many of the base units used in physics. Familiarize yourself with these base units, their symbol, and what they measure.

Name	Symbol	Measures…
Meter	m	Length
Kilogram	kg	Mass
Second	t	Time
Kelvin	K	Temperature
Mole	Mol	Atomic or molecular weight
Ampere	A	Electric current

2. Complete the table below for the following scientific prefixes. Kilo and milli have been done for you.

Name	Abbreviation	Numerical value
Pico-		
Nano-		
Micro-		
Milli-	m-	10^{-3}
Centi-		
Kilo-	k-	10^{3}
Mega-		
Giga-		

Convert the following units into the specified unit. Do not worry if the unit is not in Table 1, look at the prefixes to know what to multiply it by.

3. 21 kg = _____ mg

4. 0.015 rad = _____ mrad

5. 600 nm = _____ mm

6. 0.2 GHz = _____ Hz

7. $1m^2 =$ _____ cm^2

8. 10,000 mm^3 = _____ m^3

9. 100 $\frac{kg}{m}$ = _____ $\frac{g}{cm}$

10. 15 $\frac{m}{s}$ = _____ $\frac{km}{hour}$

Use the factor-label method to convert the following units to the nearest thousandth. **Show all work.**

Example: $1\,\frac{m}{s}$ = _____ $\frac{mile}{hr}$

$$\left(\frac{1\ m}{1\ s}\right)\left(\frac{3600 s}{1\ hr}\right)\left(\frac{3.281\ ft}{1\ m}\right)\left(\frac{1\ mile}{5280\ ft}\right) = \frac{11811.6}{5280}\frac{miles}{hr} = \frac{2.237\ miles}{hr}$$

11. 1 year = _____ seconds

12. $3 * 10^8\,\frac{m}{s}$ = _____ $\frac{ft}{week}$

13. $30\,\frac{lb}{ft}$ = _____ $\frac{kg}{m}$

14. $88\,\frac{cm}{min}$ = _____ $\frac{m}{s}$

Part 3: Scientific Notation

Complete the following questions about Scientific Notation.

Recall that for a number to be in scientific notation it must be in the form A * 10^b, where 1<A<10 or -10<A<-1 and b is the number of times the decimal place was moved to the left.

Example 1: -572.5 = -5.725 * 10^2

Example 2: 0.0231 = 2.31 * 10^{-2}

Convert the following numbers to scientific notation.

1. 19300

2. 0.00000045

3. 9000000000

4. 0.001

Convert the following numbers to normal notation.

5. 8.6400 * 10^4

6. 5.64 * 10^{-4}

7. 3 * 10^8

8. 6.67 * 10^{-11}

Multiply the following numbers and give the result in scientific notation

9. (4.5 * 10^{-8})*(1.6 * 10^8)

10. (2.7 * 10^4)*(6.3 * 10^{-2})

11. (5* 10^{-3})*(6.6* 10^{-2})

12. (5.6 * 10^7)*(7* 10^8)

Add the following numbers and give the result in scientific notation

13. (2.5 * 10^8)+(1.2 * 10^8)

14. (1.8 * 10^3)+(7.3 * 10^2)

15. (6* 10^{-2})+(6.1* 10^{-2})

16. (5.5 * 10^9)+(4* 10^{11})

Part 4: Equation manipulation

Complete the following questions involving manipulating equations

Example: $V = I * R$ Solve for I $I = \frac{V}{R}$

1. $U_s = \frac{1}{2}kx^2$ Solve for x

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

3. ${v_f}^2 = {v_i}^2 + 2a(x_f - x_i)$ Solve for a

4. $v_f = v_i + at$ Solve for t

5. $x_f - x_i = v_i t$ Solve for v_i

6. $mgh = \frac{1}{2}mv^2$ Solve for v

7. $T_s = 2\pi\sqrt{\frac{m}{k}}$ Solve for k

Part 5: Greek Letters Quizlet/Flashcards

In physics, you will often see a variety of ways to name a variable, from v for velocity to F_N for normal force. In many cases, though, Greek letters are the default way to represent many variables. In the list below, you will find a list of Greek letters, their pronunciations, and the most common uses for them. You will need to know these by heart in this class. To effectively study them, please create a Quizlet or flashcard set with the following terms and definitions and practice these over the summer. You will be expected to take a quiz on them the first week of school.

Greek Letter	Pronunciation	Common uses
α	Alpha (Al-fuh)	Angular acceleration, nuclear radiation
β	Beta (Bay-tuh)	Nuclear radiation
ε	Epsilon (Ep-salon)	Permittivity
η	Eta (Ey-tuh)	Charge density
γ	Gamma	Nuclear radiation
λ	Lambda (Lamb-duh)	Wavelength
μ	Mu (Mew)	Friction coefficient
π	Pi (Pie)	Irrational number
θ	Theta (they-tuh)	Angular position/displacement
ρ	Rho (Row)	Density, resistivity
σ	Sigma	Electrical conductivity
τ	Tau (As in “towel)	Torque
ω	Omega	Angular velocity/frequency
Δ	Delta	A change in a quantity
Σ	Sigma	The summation of multiple quantities
Ω	Omega	Measure of Resistance (Ohms)

Part 6: Assigned Reading for Day One

Section 1:

Before coming into class on the first day, you must have some prerequisite understanding of the nature of physics. For this part of the Summer Assignment completely read and take detailed notes on the first chapter of the LibreTexts OpenStax Physics: The Nature of Science and Physics. This can be found at the url below or by going to https://phys.libretexts.org/ and typing in the search bar in the upper left "the nature of science and physics" and the first result should lead you to the url below.

https://phys.libretexts.org/Bookshelves/College_Physics/Book%3A_College_Physics_(OpenStax)/01._The_Nature_of_Science_and_Physics

Please have detailed notes (written, not typed) ready to be turned in on the first day of school.

Section 2:

Graphing in previous math classes had you look at the relationship between x and y variables or the function of y and x itself. In AP Physics, you will assign physical significance to your graphs. In some cases, slope will represent velocity, acceleration, and many other possible variables. Please read the instructions at the url below and commit the steps below to heart, as we will always use these in class.

https://www.mun.ca/physics/undergraduates/fylabs/p1020/ManPlotting.pdf

For plotting and interpreting graphs follow the steps below:

1. Identify which physical is the independent (x) and dependent (y) variable.
2. Identify a physics equation that relates the variables. [example: F = Ma]
3. Note the relationship in your date (linear, quadradic, etc.).
4. Write down the general form of the equation [example: $y = mx+b$, $y = ax^2+bx+c$]
5. Compare the physical equation to the equation of the data fit
   [example: F = Ma to y = mx thus m = M and b = 0]

AP PHYS 1 & C Notes Rubric

Note: you do not need to take notes from Section 1.0 and 1.E ("Prelude to Science and the Realm of Physics, Physical Quantities, and Units" and "The Nature of Science and Physics (Exercises)")

Originality	**Poor (30)**	**Good (35)**	**Excellent (40)**
Do you notes reflect your own wording of key points? Are they more than just a direct quote from the text?	Notes are only direct copies of the text with no change (or notes are incorrect)	Some notes are rephrased while keeping the key information but other notes are either incorrect or direct copies from the text	Notes contain key information written while bring rephrased by using the students own words
On-time	**Poor (5)**	**Good (10)**	**Excellent (15)**
Did you turn in your notes on the assigned due date?	Turned in more than 1 day late	Turned in 1 school day late (if due on Friday but was turned in the following Monday)	Turned in on time
All headings and subheadings covered	**Poor (10)**	**Good (15)**	**Excellent (20)**
Did you use the headings and subheadings provided in the text to guide your notes? Did you write at least one note per subheading?	3+ subheadings skipped per section (or more than 7 subheadings skipped total)	2+ subheadings skipped per section (or more than 5 subheadings skipped total)	0 – 1 subheadings skipped per section. All key information covered. Ask me if you think some subheadings can go together because I may agree with you and let you skip some.
Minimum 2 examples per section	**Poor (15)**	**Good (20)**	**Excellent (25)**
Do your notes contain 2 examples per section (such as how they measure the meter) in your notes?	No example or poor example choices used from the text	Has some good examples from the text but most are either poor or are missing	Each section contains two good examples based on what the section was discussing

Part 7: AP PHYS C only: The Big 5 Equation Practice

The following equations will be the first ones we will go over in class. Complete the following questions using the equations provided below. When choosing which equation to use be sure to look at what you know and what you do not know and see which equation best fits.

Equation 1: $\Delta x = x_f - x_i = \bar{v}t = \frac{1}{2}(v_f + v_i)t$

Equation 2: $v_f = v_i + at$

Equation 3: $x_f = x_i + v_i t + \frac{1}{2}at^2$

Equation 4: $x_f = x_i + v_f t - \frac{1}{2}at^2$

Equation 5: ${v_f}^2 = {v_i}^2 + 2a\Delta x$

Note: x represents position [meters], v represents velocity [meters/second], a represents acceleration [meters/second^2], t represents time [seconds], the subscript f represents final, and the subscript i represents initial. Acceleration is assumed to be uniform (a constant value).

1. If a ball initially at rest (v_i = 0 m/s) is dropped from a building and takes 3 seconds to hit the ground, what is the final velocity of the ball and how tall was the building? (note: acceleration is due to gravity which has a value of -9.81 m/s^2)

2. A car increases speed from 20 m/s to 80 m/s in 2.5 seconds. What is the acceleration of the car and what distance did it travel while it was accelerating?

3. A cat is able to jump to a vertical height of 1.5m. What speed does the cat initially leave the ground at and what was its total time in the air (from the initial jump to landing back on the ground)? (note: acceleration is due to gravity and when it reaches its maximum height the velocity = 0 m/s)

4. A ball is thrown vertically up and takes 7 seconds to land on the ground. What was its maximum height? (note: the ball reaches its maximum height at half of the time it was in the air)

5. Someone threw a penny off of a 380m skyscraper. How long does it take to hit the ground and what speed was it traveling at? (note: acceleration is due to gravity)

6. While coming to a stop, a car left skid marks that were 300m in length, If the car was stopping with an acceleration of -4 m/s^2, what speed was it initially traveling at?

7. What speed would a football need to be thrown vertically to reach a maximum height of 90m? (note: acceleration is due to gravity)

Part 8: AP PHYS C only: Differentiation and the Derivative

Note: Bold & Underlined topics are the most important ones. Be sure to focus on those the most.

Go on Khan academy and take/review the Differential Calculus topics of:

Derivative definition

Differentiability

Power rule

Derivative rules: constant, sum, difference, and constant multiple

Combining the power rule with other derivative rules

Product rule

Quotient rule

Chain rule

More chain rule practice

In AP Physics C it is generally assumed that you know how to differentiate and integrate on day 1. For those who have taken calculus before a refresher on differentiation will be helpful. **For those who are currently taking calculus be sure to understand on day 1 the concept of taking a derivative for polynomial functions and what a derivative "means"**. Due to the course only focusing on Newtonian Physics (no Electricity and Magnetism) we will slowly introduce more difficult differentiation and integration questions throughout the first few months (so do not worry if you have not learned them yet).

Complete the problems below. If you can do these problems confidently you should be fine when class starts. Remember to use khan academy or **reach out to me** if you have any problems.

1. What is the formal definition of the derivative as a limit?

2. Use the formal definition to find the derivative of $f(x) = x^3$

3. Using the power rule, what is the derivative of x^5?

4. Using the power rule, what is the derivative of $\frac{1}{x^3}$?

5. What is the derivative of $f(x) = 3x^6 + 2x^2 - 8 - 2\sqrt{x} - \frac{1}{x^5}$

6. Using the product rule, what is the derivative of $(x^2 + 7) * (x^3 - 3)$

7. Using the quotient rule, what is the derivative of $\frac{x^3-7}{x^2+5}$?

8. Using the chain rule, what is the derivative of $(x^2 + 5)^4$

9. Using the chain rule, what is the derivative of $\sqrt[3]{(3x^2 + 3x - 7)}$?

Part 9: Checklist

Please us this checklist to keep track of which parts of the Summer Assignment you have completed. This will also serve as a guide for what to bring for the first day of class.

- Completed the Trigonometry Review
- Completed Unit Conversion and Dimensional Analysis
- Completed Scientific Notation
- Completed Equation Manipulation
- Created the Green Letters Quizlet/Flashcards
- Read and took notes for Part 1 of the Assigned Reading
- Read Part 2 of the Assigned Reading
- AP PHYS C ONLY: Completed the Big 5 Equation Practice
- AP PHYS C ONLY: Completed Differentiation and the Derivative Practice

Be prepared for a quiz during the first week on any/all of these topics.