Name:___________________________AP Physics Summer AssignmentDue Date: 8/17/22

Welcome to AP Physics 1! This is a challenging, college-level physics course. This summer assignment was created to prepare you for the kind of math that will be used class this year If you have trouble with these problems, there are some websites that may be helpful to you:

http://www.aplusphysics.com/courses/honors/intro/math_review.html
http://www.physicsphenomena.com/PhysicsMathReview.htm

It is important that all of the work in this assignment is your own – these are all things that you will be asked to do regularly in class. This is a good opportunity to identify and strengthen any weaknesses in fundamental skills. There will be plenty of time for appropriate collaboration – once we start the actual *physics*.

There are 7 Parts to this assignment which you will find below. This assignment will take a decent amount of time to complete – pace yourself and do it over several sessions.

See you in August!

Part 1: Significant Figures

- Significant figures tell us how well we know values that come from measurements we have made.
  - If I use a very precise measuring tool like calipers, I will be able to tell you length of a dry erase marker to a more exact measurement than if I use a ruler.
- When we use these directly measured numbers to calculate other quantities, we need a system to tell us how exactly we know those calculated numbers.
- When the number is a decima**l**, begin on the **left** side of the number.
  - Start counting from the first non-zero number and continue counting through the rest of the number.
    - Example: 14.6 has 3 significant figures
    - Example: 901.05 has 5 significant figures
    - Example: 0.000890 has 3 significant figures
- When the number is an intege**r**, begin on the **right** side of the number.
  - Start counting from the first non-zero number and continue counting through the rest of the number.
    - Example: 18 has 2 significant figures
    - Example: 3740 has 3 significant figures
    - Example: 10609 has 5 significant figures
- When a number is expressed in scientific notation, only the first part of the number has significant figures, not the x $10^{\#}$ part.
    - Example: 1.431 x 10^7 has 4 significant figures

State the number of significant figures in each number:

1. 30 __________
2. 9.3 x 10^4 __________
3. 0.0084 __________
4. 3.700080 __________
5. .0004050 __________
6. 1.111 x 10^{-5} __________
7. 540,003,000 __________

Part 2: Scientific Notation

- Scientific notation is used to express numbers that are very large or very small.
- The exponent on the "10" tells you how many places to move the decimal point when converting the number back to standard notation.
  - A positive exponent indicates a large number
  - A negative exponent indicates a very small number

Express each number in scientific notation, using the same number of significant figures as the original:

8. 7,640,00 __________
9. 8327.2 __________
10. 0.0093 __________
11. 0.000000030 __________

Part 3: Unit Conversions

- We will often convert between different units that measure the same quantity. This is especially common with the metric prefixes listed here.

12. Fill in the chart:

Prefix	Power	Symbol
Tera		
Giga-		
Mega-		
Kilo-	10^3	k
Centi-		
Milli-		
Micro-		
Nano-		
Pico-		

- To convert between units, we can use a method of dimensional analysis known as the factor-label method. We multiply a given quantity by a conversion factor that has been set up to cancel out the old unit and leave us with the original quantity expressed as a new unit. See the example below:

$$\underbrace{4.5\ \text{inches}}_{\text{given}} \times \frac{2.54\ \text{cm}}{1\ \text{inch}} = \underbrace{11.4\ \text{cm}}_{\text{desired}}$$

Perform the following unit conversions using the values you filled in the chart above.

13. 50.3 gigabytes to terabytes

14. 10,000. millimeters to meters

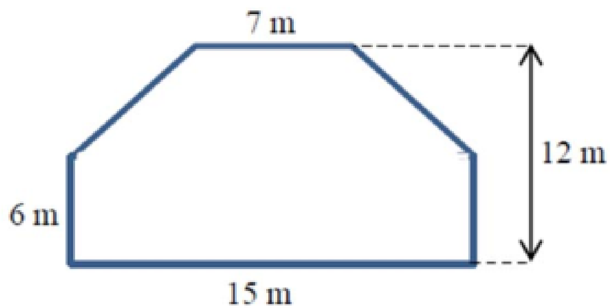
15. 400.99 kilograms to micrograms

16. Calories are used to express energy quantities. If 1 calorie = 4.184 joules, how many calories would be equivalent to 1.45 × 10 5 joules?

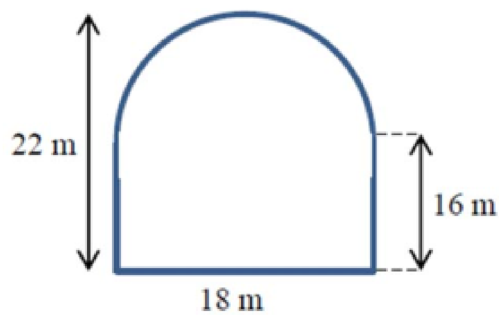
17. If there are 745 Watts for every unit of horsepower, how many horsepower would it take to power one hundred-watt light bulb?

Part 4: Geometry

18. Area = ________________

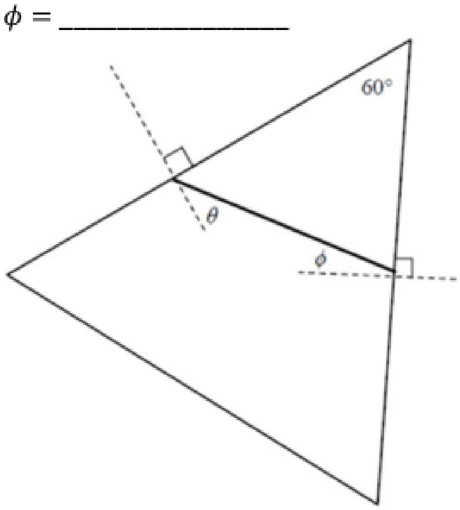


19. Area = ________________

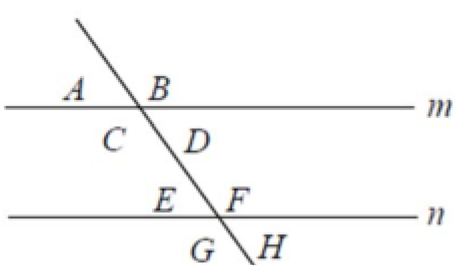


20. $\theta = 16^o$

$\phi =$ ________________



21. Lines m and n are parallel.



$A = 75°$

$B =$ ________

$C =$ ________

$D =$ ________

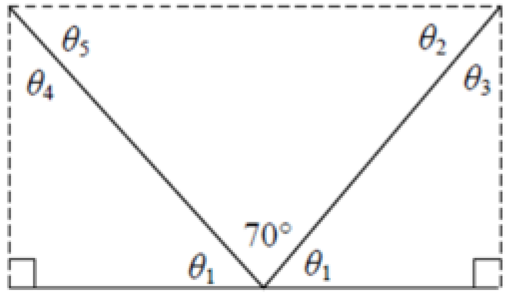
$E =$ ________

$F =$ ________

$G =$ ________

$H =$ ________

22.



θ_1 = ________

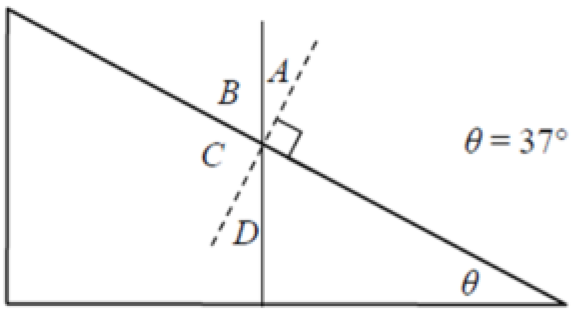
θ_2 = ________

θ_3= ________

θ_4 = ________

θ_5 = ________

23.



A = ________

B = ________

C= ________

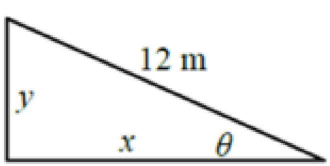
D = ________

Part 5: Trigonometry

- When we are presented with a right triangle, we can use some basic trigonometric identities to solve for the sides of the triangle.
  - Sin = opposite/hypotenuse
  - Cos = adjacent/hypotenuse
  - Tan = opposite/adjacent

Calculate the unknowns using trigonometry. Use a calculator and round your answers to 3 significant figures.

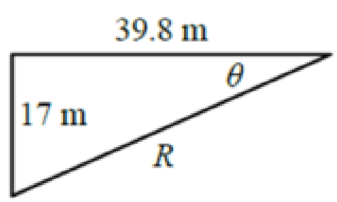
24.



$\theta = 30°$

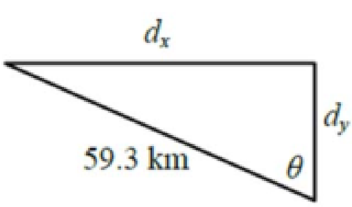
$y =$ ________
$x =$ ________

26.



$R =$ ________
$\theta =$ ________

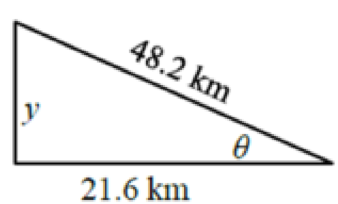
25.



$\theta = 60°$

$d_x =$ ________

27.



$y =$ ________
$\theta =$

For the following questions, consider only angles where $0 < \theta < 90^o$

28. At what angle is sine at a maximum? __________
29. At what angle is sine at a minimum? __________
30. At what angle is cosine at a maximum? __________
31. At what angle is cosine at a minimum? __________
32. At what angle are sine and cosine equal? __________
33. As the angle increases from 0 to 90, what happens to the value of sine?__________
34. As the angle increases from 0 to 90, what happens to value of cosine? __________

Part 6: Manipulating Equations

- We can solve an equation "for" a variable by moving variables around until the equation says 'variable' = …
  - Ex: Given that $v = \frac{x}{t}$, $solve\ for\ t$
    - $v = \frac{x}{t}$
    - $vt = x$
    - $t = \frac{x}{v}$

Solve the equations for the variable indicated. Show all of your steps.

35. $v=\frac{x}{t}$ *(for t)*

36. $\frac{1}{2}mv^2=\frac{1}{2}kx^2$ *(for k)*

37. $mgh=\frac{1}{2}mv^2$ *(for v)*

38. $\frac{m_1 v^2}{r}=m_2 gh$ *(for r)*

39. $T=2\pi\sqrt{\frac{L}{g}}$ *(for g)*

40. $\frac{1}{R_1}+\frac{1}{R_2}=\frac{1}{R_{eq}}$ *(for R_2)*

Part 7: Graphing

- The goal of a physics experiment is to collect data that can be analyzed in some way that will yield useful information about how two variables relate to one another.
- Some general tips for graphing:
  - + The independent variable should go on the horizontal axis and the dependent variable should go on the vertical axis.
  - + Always label your axes, and include the unit in which your quantities are expressed
  - + A graph needs a concise title to help a reader understand what is being displayed
  - + Use a straight-edge to draw a line of best fit for your data. DO NOT CONNECT YOUR POINTS.
  - + The slope of the line of best fit can be calculated – if we design an experiment properly this will yield some important quantity of the system being studied.
  - + When finding the slope of your line of best, do not use data points that you collected during the experiment. Use other points that happen to fall on the line.
- Let's say that we need to determine the spring constant, an indicator of stiffness, of a spring. To find the spring constant we keep adding weight to the spring and measure how far it stretches from the starting position.

Graph this data and calculate the slope of the line of best fit:

Force (N)	Stretch (m)
0.2	0.15
0.4	0.35
0.6	0.65
0.8	0.75
1.1	1.30
1.5	1.60
2.0	2.10

41. **SLOPE** $\left(\frac{\Delta y}{\Delta x}\right)$ =