

# AP Physics Summer Assignment

## I Read One of The following:

- *Rocket Boys by H. Hickam*
- *The Martian by Andy Weir*
- *A Brief History of Time by S. Hawking*

❖ (Write a one page review of the book you read.)

## II Visit One of the following:

- Brookhaven National Lab
- Museum of Natural History
- Liberty Science center

❖ (Write a one page synopsis of your visit.)



## III Math Section

Math is the Language of Physics. This assignment will review all of the prerequisite knowledge expected of you. There are 3 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

Use a 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 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.  $(3 \times 10^6) \cdot (2 \times 10^4) =$

6.  $(4 \times 10^8) \cdot (5 \times 10^{-3}) =$

7.  $(8 \times 10^3) / (2 \times 10^5) =$

8.  $(1.2 \times 10^4) / (6 \times 10^{-2}) =$

9.  $(7 \times 10^3)^2 =$

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

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<sup>2</sup> = \_\_\_\_\_ cm<sup>2</sup>
6. 40 mm<sup>3</sup> = \_\_\_\_\_ m<sup>3</sup>
7. 1 g/cm<sup>3</sup> = \_\_\_\_\_ kg/m<sup>3</sup>
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:  $7.8 \times 10^{-6}$  would be entered as 7.8 E

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

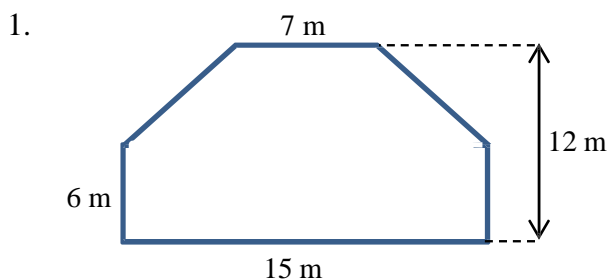
10.  $(5.32 \times 10^{-2})(4.87 \times 10^{-4}) =$

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

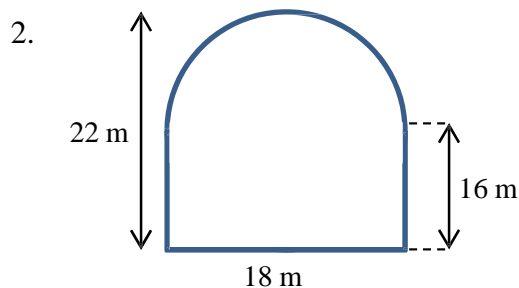
12.  $(6.12 \times 10^{-3})^3$

### Part 2: Geometry

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



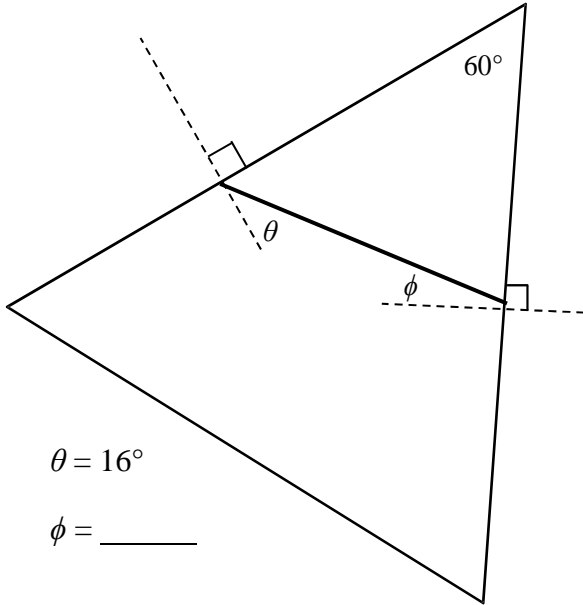
Area = \_\_\_\_\_



Area = \_\_\_\_\_

Calculate the unknown angle values for questions 3-6.

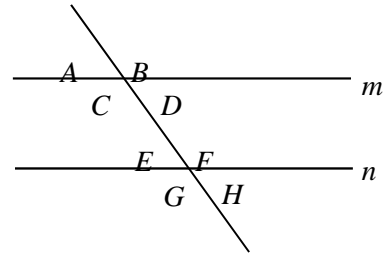
3.



$\theta = 16^\circ$

$\phi = \underline{\hspace{2cm}}$

4.

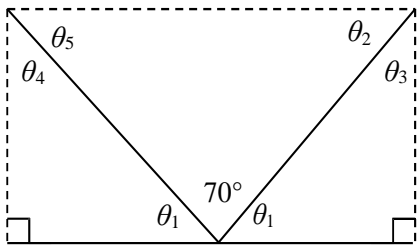


Lines  $m$  and  $n$  are parallel.

$A = 75^\circ$      $B = \underline{\hspace{1cm}}$      $C = \underline{\hspace{1cm}}$      $D = \underline{\hspace{1cm}}$

$E = \underline{\hspace{1cm}}$      $F = \underline{\hspace{1cm}}$      $G = \underline{\hspace{1cm}}$      $H = \underline{\hspace{1cm}}$

5.



$\theta_1 = \underline{\hspace{2cm}}$

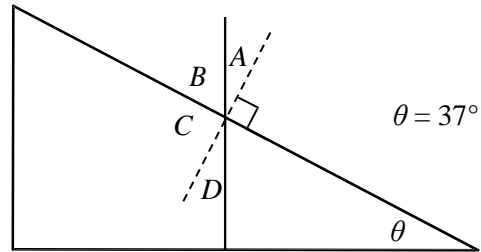
$\theta_2 = \underline{\hspace{2cm}}$

$\theta_3 = \underline{\hspace{2cm}}$

$\theta_4 = \underline{\hspace{2cm}}$

$\theta_5 = \underline{\hspace{2cm}}$

6.



$A = \underline{\hspace{1cm}}$      $B = \underline{\hspace{1cm}}$

$C = \underline{\hspace{1cm}}$      $D = \underline{\hspace{1cm}}$

**Part 3: Trigonometry**

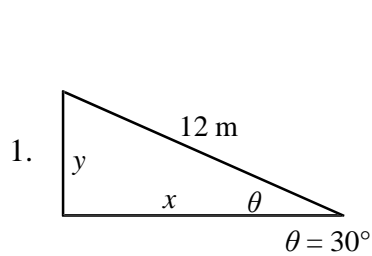
Write the formulas for each one of the following trigonometric functions. Remember SOHCAHTOA!

$\sin\theta =$

$\cos\theta =$

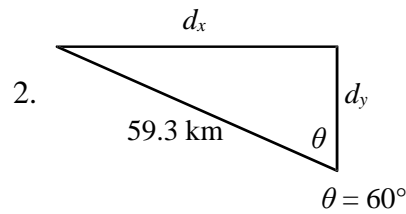
$\tan\theta =$

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!)



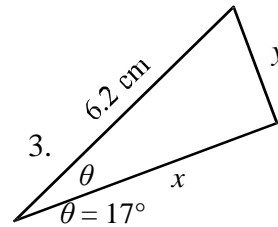
$y =$  \_\_\_\_\_

$x =$  \_\_\_\_\_



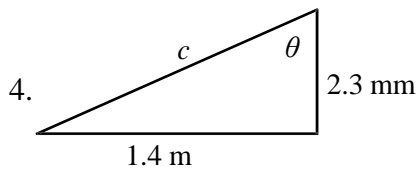
$d_x =$  \_\_\_\_\_

$d_y =$  \_\_\_\_\_



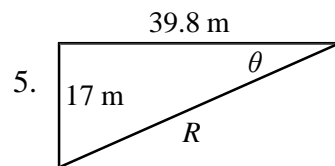
$x =$  \_\_\_\_\_

$y =$  \_\_\_\_\_



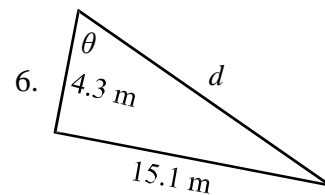
$c =$  \_\_\_\_\_

$\theta =$  \_\_\_\_\_



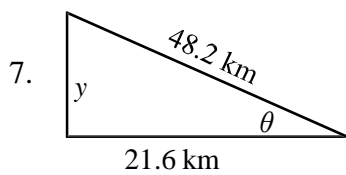
$R =$  \_\_\_\_\_

$\theta =$  \_\_\_\_\_



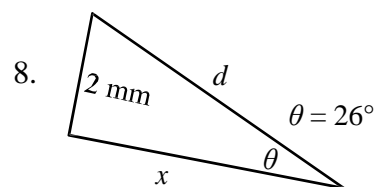
$d =$  \_\_\_\_\_

$\theta =$  \_\_\_\_\_



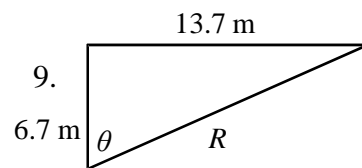
$y =$  \_\_\_\_\_

$\theta =$  \_\_\_\_\_



$x =$  \_\_\_\_\_

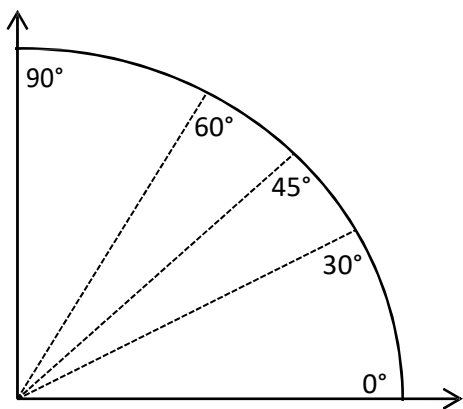
$d =$  \_\_\_\_\_



$R =$  \_\_\_\_\_

$\theta =$  \_\_\_\_\_

You will need to be familiar with trigonometric values for a few common angles. Memorizing this diagram in degrees or the chart below will be very beneficial for next year (in math and physics!). In the diagram, the *cosine* of the angle is the *x-coordinate* and the *sine* of the angle is the *y-coordinate* (in other words, each radius of the circle shown is the hypotenuse of a right triangle). Write the ordered pair (in fraction form) in the table below for each of the angles shown on the quarter-circle.



$\theta$	$\cos\theta$	$\sin\theta$
$0^\circ$		
$15^\circ$		
$30^\circ$		
$45^\circ$		
$60^\circ$		
$90^\circ$		

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?