AP Physics 1 Summer Assignment 2017

This summer assignment is for students enrolled in AP Physics 1 for the 2017-18 school year. You do not need any prerequisite physics knowledge to do this work. HOWEVER, the material covered in this assignment is necessary to know before beginning the course. If you are lacking some of this knowledge, it is imperative that you bring yourself up to speed over the summer so that you are able to complete this assignment correctly and you are ready for the course.

Complete this assignment before the first day of school. Your work will be graded. There will be a quiz on this material on the first Friday of school.

Complete all questions without a calculator, unless otherwise indicated. (You will not have a calculator for the quiz.)

Although you will have full use of a calculator during the AP exam, you have limited time. Being able to do math in your head quickly is more efficient than using a calculator. Only a few questions, if any, on the AP exam will actually require using a calculator.

Prefixes

Memorize the following prefixes. (Although you will get them on the AP exam you will not have time to waste looking up prefixes.)

PREFIXES		
Factor	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Significant Figures & Scientific Notation

Note about Significant Figures: While significant figures are important for weekly homework and laboratory assignments, the current accepted practice on the AP exam is to round final answers to no more than 3 significant figures. Do not round in the middle of problems.

Often times multiple numbers in a problem contain scientific notation and will need to be reduced quickly by hand. Before you practice, remember the rules for exponents.

- When scientific notation numbers are multiplied together, you add the exponents and multiply the bases.
- When scientific notation numbers are divided, you subtract the exponents and divide the bases.
- When a scientific notation number is raised to another exponent, you multiply the exponents and raise the base by that exponent.

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

1. $(3\times10^{6})\cdot(2\times10^{4})$ =
2. $(4\times10^{8})\cdot(5\times10^{-3})$ =
3. $(8\times10^{3}) / (2\times10^{5})$ =
4. $(1.2\times10^{4}) / (6\times10^{-2})$ =
5. $(7\times10^{3})^{2}$ =
6. $(2\times10^{-3})^{3}$ =

Conversion Factors

The important part is showing the work using conversion factors (without a calculator). You may then use a calculator to find the final answer.
(1 meter = 39.3701 inches, 1 pound = 453.592 grams, 1 quart = 32 oz)

7. 452 inches to millimeters

8. 212 millimeters to inches

9. 517 millimeters to meters

10. 149 grams to pounds

11. 4900 seconds to hours

12. 319 ounces to quarts

13. 20 m/s to km/hr

How to quickly convert using prefixes:

This is a trick that will help you do conversions with prefixes quickly.

If you want to remove a prefix, such as milligram to gram – replace the milli- with the appropriate base ten exponent. Example: 5 mg = 5×10^{-3} g (The milli- was replaced with 10^{-3})

If you want to add a prefix, such as gram to kilogram – you need to add in the inverse base ten exponent in addition to the prefix that you add. Example: 6 g = 6×10^{-3} kg. This works because the kilo- represents 10^{3} and the 10^{-3} that you added kept the amount of mass the same.

Remember if there is an exponent on the unit, such as cm^2, the conversion should be raised to the same exponent as well.

Convert the following numbers into the specified unit.

14. 24 g = _____ kg

15. 94.1 MHz = _____ Hz

16. 6 Gb = _____ kb

17. 640 nm = _____ m

18. 3.2 m^2 = _____ cm^2

19. 40 mm^3 = _____ m^3

20. 1 g/cm^3 = _____ kg/m^3

Algebraic Manipulation

Use algebra to solve for the indicated variable. Some variables have a subscript, such as v_0. Variables with subscripts are treated as one variable.

Example: Given $V = IR$, solve for I.

$\frac{V}{R} = \frac{IR}{R} \rightarrow I = \frac{V}{R}$

21. Given $v = v_0 + a_x t$ solve for a_x

22. Given $F_f = \mu F_n$ solve for μ

23. Given $F = m a$ solve for a

24. Given $K = \frac{1}{2} m v^2$ solve for v

25. $T = 2\pi\sqrt{l/g}$ solve for g

26. $F = G\frac{mM}{r^2}$ solve for r

27. $mgh = \frac{1}{2}mv^2$ solve for v

28. $\frac{1}{f} = \frac{1}{a} + \frac{1}{b}$ solve for b

Complete this section with a calculator. Show all your work.

Reference Charts:

GEOMETRY AND TRIGONOMETRY

Rectangle
$A = bh$

Triangle
$A = \frac{1}{2}bh$

Circle
$A = \pi r^2$
$C = 2\pi r$

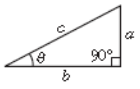
Rectangular solid
$V = \ell wh$

Cylinder
$V = \pi r^2 \ell$
$S = 2\pi r\ell + 2\pi r^2$

Sphere
$V = \frac{4}{3}\pi r^3$
$S = 4\pi r^2$

A = area
C = circumference
V = volume
S = surface area
b = base
h = height
ℓ = length
w = width
r = radius

Right triangle
$c^2 = a^2 + b^2$
$\sin\theta = \frac{a}{c}$
$\cos\theta = \frac{b}{c}$
$\tan\theta = \frac{a}{b}$



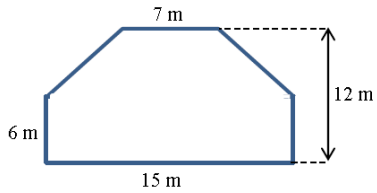
VALUES OF TRIGONOMETRIC FUNCTIONS FOR COMMON ANGLES

θ	0°	30°	37°	45°	53°	60°	90°
$\sin\theta$	0	$1/2$	$3/5$	$\sqrt{2}/2$	$4/5$	$\sqrt{3}/2$	1
$\cos\theta$	1	$\sqrt{3}/2$	$4/5$	$\sqrt{2}/2$	$3/5$	$1/2$	0
$\tan\theta$	0	$\sqrt{3}/3$	$3/4$	1	$4/3$	$\sqrt{3}$	∞

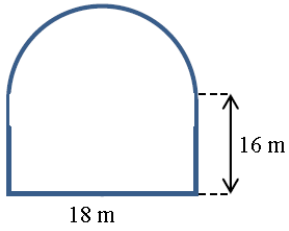
Area

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

29.

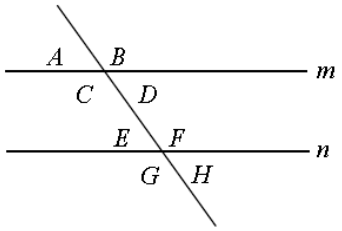


30.



Angles

31. Calculate the unknown angle values.

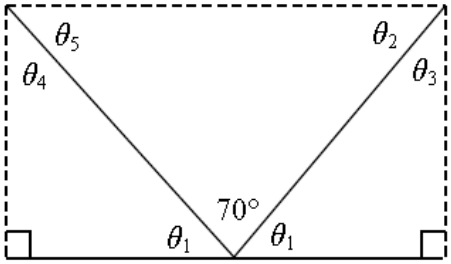


Lines m and n are parallel.

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

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

32.



$\theta_1 =$ _____

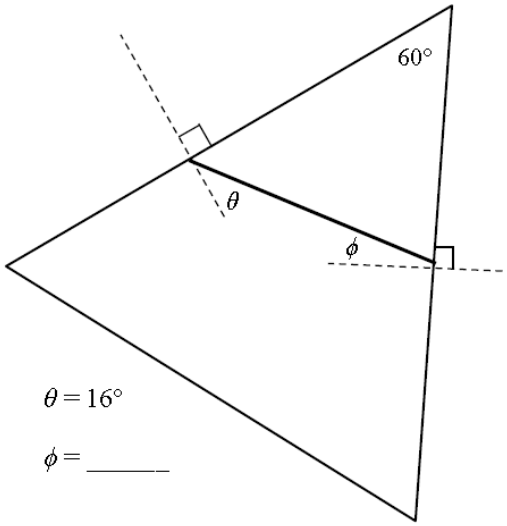
$\theta_2 =$ _____

$\theta_3 =$ _____

$\theta_4 =$ _____

$\theta_5 =$ _____

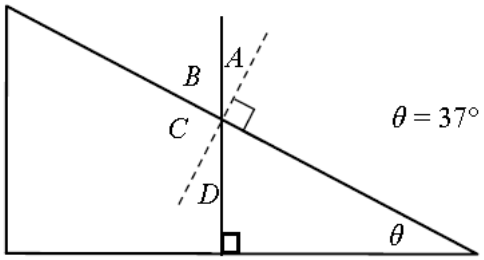
33.



$\theta = 16°$

$\phi =$ _____

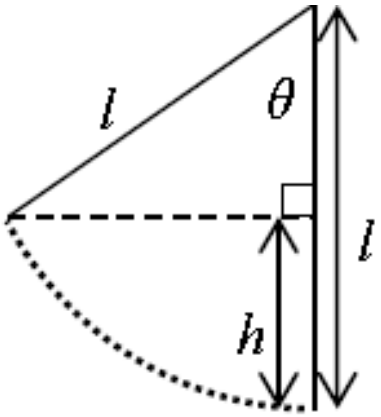
34.



$A =$ _____ $B =$ _____

$C =$ _____ $D =$ _____

35.

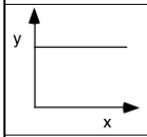
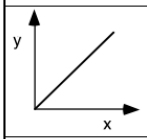
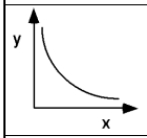
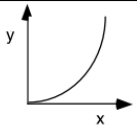
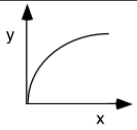


a) Find an expression for h in terms of l and θ.

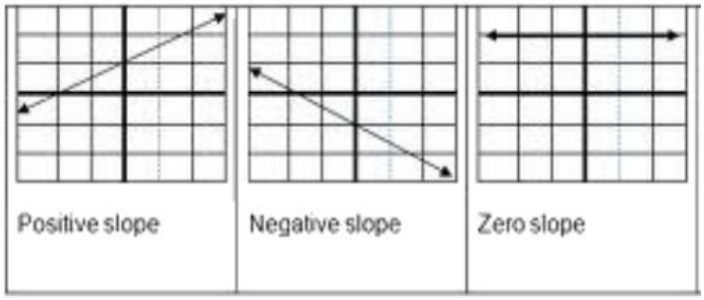
b) What is the value of h if l = 6 m and θ = 40°?

Graphing

The chart below reviews the basic types of graphs that we will be working with in physics. Pay attention to the way to "linearize" the graph. If you graph y vs x and you get a parabolic curve, then you know that it is a quadratic relationship between y and x. You can get a linear looking curve by graphing y vs. x^2.

Graph shape	Written relationship	Modification required to linearize graph	Algebraic representation
	As x increases, y remains the same. There is no relationship between the variables.	None	$y = b$, or y is constant
	As x increases, y increases proportionally. Y is directly proportional to x.	None	$y = mx + b$
	As x increases, y decreases. Y is inversely proportional to x.	Graph y vs $\frac{1}{x}$, or y vs x^{-1}	$y = m\left(\frac{1}{x}\right) + b$
	Y is proportional to the square of x.	Graph y vs x^2	$y = mx^2 + b$
	The square of y is proportional to x.	Graph y^2 vs x	$y^2 = mx + b$

Slopes for Linear Graphs:



36. A student performed an experiment with a metal sphere. The student shot the sphere from a slingshot and measured its maximum height. The sphere was shot six times at six different angles above the horizon.

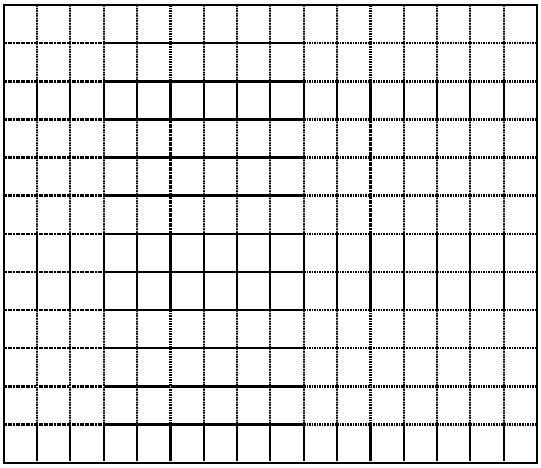
a. What is the relationship being studied?

b. What is the independent variable in this experiment?

c. What is the dependent variable in this experiment?

d. What variables must be held constant throughout this experiment?

37. Plot a graph using proper graphing techniques for the following data recorded for an object falling from rest (time is on the x-axis):



Time (s)	Velocity (m/s)
1	10
2	19
3	30
4	39
5	48
6	58
7	69

a) What kind of curve did you obtain?

b) What is the relationship between the variables?

c) How much time is required for the object to reach 50m/s?

d) What would you expect the velocity to be after 3.5s?