

AP Physics 1 Summer Assignment

Welcome to AP Physics 1 at Hampton High School. This course will require a serious commitment and independent work on the part of every student in order to ensure a pace by which we can master the material before the AP testing in May. 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

AP Physics 1 is an algebra-based, introductory college-level physics course. Students cultivate their understanding of physics through inquiry-based investigations as they explore these topics: kinematics; dynamics; circular motion and gravitation; energy; momentum; simple harmonic motion; torque and rotational motion; electric charge and electric force; DC circuits; and mechanical waves and sound.

ASSIGNMENT (Complete this assignment before the first day of school. Your work will be graded.)

Go to the following web site: http://www.applusphysics.com/courses/ap1/AP1_Physics.html

View the following videos:

- A. Take 1 page of notes on each video. Include images wherever possible.
- B. Second page: The videos have some example problems. Write down each question and each of your answers. Include any calculations for math problems. Note the web site is an excellent resource and you should use it throughout the year.

• Introduction What Is Physics?

<http://www.applusphysics.com/courses/regents/videos/WhatIsPhysics/WhatIsPhysics.html>

• Math Review

1. Significant Figures
<http://www.applusphysics.com/courses/regents/videos/SigFigs/SigFigs.html>
2. Scientific Notation
<http://www.applusphysics.com/courses/regents/videos/SciNotation/SciNotation.html>
3. Metric System
http://www.applusphysics.com/courses/regents/videos/Metric_System/Metric_System.html
4. Vectors and Scalars
<http://www.applusphysics.com/courses/regents/videos/VectorScalar/VectorScalar.html>

• Mechanics, Kinematics

1. Defining Motion
http://www.applusphysics.com/courses/honors/videos/Define_Motion_Hon/Define_Motion_Hon.html
2. Graphing Motion
http://www.applusphysics.com/courses/honors/videos/Graphing_Motion_Hon/Graphing_Motion_Hon.html
3. Kinematic Equations
http://www.applusphysics.com/courses/honors/videos/KinEqns_Hon/KinEqns_Hon.html
4. Free Fall
http://www.applusphysics.com/courses/honors/videos/FreeFall_Honors/FreeFall_Honors.html

Significant Figures and Scientific Notation Review

- 1) How many significant figures do the following numbers have?

- a.) 6.001 Answer: _____ d.) 27.00 Answer: _____
- b.) 0.0080 Answer: _____ e.) π Answer: _____
- c.) 206,000 Answer: _____

Directions: Find the following. Final answers should be in scientific notation with the correct number of significant figures.

2.) $(5.0 \times 10^{-5})(2.9 \times 10^2)$

3.) $(3.25 \times 10^4 + 7.4 \times 10^3)$

4.) $6.000 \times 10^{-11} \frac{1.00 \times 10^{26}}{2.00 \times 10^7}$

5.) $\frac{8400}{1.2 \times 10^7}$

Unit Conversions Review

6.) Finish the SI prefix table below. Follow the example of the centi- prefix. You will need to memorize these.

| Symbol | Name | Numerical Equivalent |
|--------|-------|----------------------|
| n | | |
| μ | | |
| m | | |
| c | Centi | 10^{-2} |
| k | | |
| M | | |
| G | | |

7.) 16.7 kilograms is how many grams?

8.) 560 nm is how many meters?

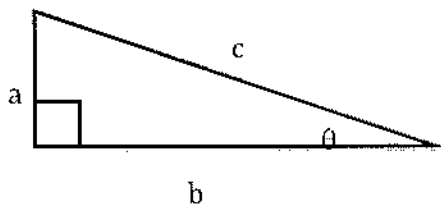
9.) 15 years is how many seconds?

10.) 8.99×10^9 seconds is how many years?

11.) 2.998×10^8 m/s is how many kilometers per hour?

Trigonometry Review

Directions: Use the figure below to answer problems 15-25. Simplify as much as you can.



12.) Find c if given a and b .

13.) Find a if given b and c .

14.) Find a if given c and θ .

15.) Find b if given a and θ .

16.) Find c if given b and θ .

17.) Find θ if given b and c .

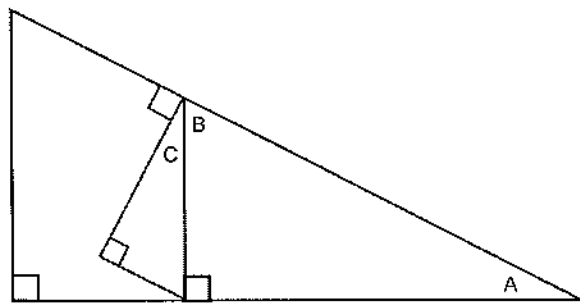
18.) Find θ if given a and b .

19.) If $a = 2.0$ and $c = 7.0$, what is b ?

20.) If $c = 10.0$ and $\theta = 60^\circ$, what is b ?

21.) If $a = 12.0$ and $\theta = 30^\circ$, what is b ?

22.) Using the properties of triangles, prove that $\angle A \cong \angle C$ in the drawing below.



Answer:

23.) For what angles (in degrees) does $\sin \theta \approx \theta$? Describe why mathematically.

24.) Complete the table below without using a calculator.

| θ | 0° | 30° | 45° | 60° | 90° |
|---------------|-----------|------------|------------|------------|------------|
| $\sin \theta$ | | | | | |
| $\cos \theta$ | | | | | |
| $\tan \theta$ | | | | | |

25.) 360 degrees = _____ radians.

26.) 4.5 revolutions = _____ radians.

27.) Find the length of an arc with a radius of 6.0 m swept across 2.5 radians.

28.) Find the length of an arc with a radius of 10.0 m swept across 100 degrees.

Algebra Review

Directions: Solve the following equations for the given variable and conditions. Simplify if needed.

Example: $2x + xy = z$. Solve for x .

$$x(2 + y) = z$$

$$x = \frac{z}{2 + y}$$

29.) $v_1 + v_2 = 0$ Solve for v_1 .

30.) $a = \frac{v}{t}$. Solve for t .

31.) $v_f^2 = v_i^2 + 2ad$

A.) Solve for v_i .

B.) Solve for d .

32.) $d_f = d_i + v_o t + \frac{1}{2} a t^2$

A.) Solve for v_o .

B.) Solve for t , if $v_o = 0$.

C.) Solve for t , if $d_i = d_f$.

33.) $F = m \frac{v_f - v_i}{t_f - t_i}$

A.) Solve for v_f , if $t_i = 0$.

B.) Solve for t_f , if $v_f = 0$ and $t_i = 0$.

34.) $a_c = \frac{v^2}{r}$. Solve for v .

35.) $mg \sin \theta = \mu mg \cos \theta$. Solve for θ .

36.) $\frac{1}{2}mv_f^2 + mgh_f = \frac{1}{2}mv_i^2 + mgh_i$
A.) Solve for h_f if $h_i = 0$ and $v_f = 0$.

B.) Solve for v_f if $h_f = 0$.

37.) $Ft = mv_f - mv_i$ Solve for v_f .

38.) $m_1v_{i1} + m_2v_{i2} = (m_1 + m_2)v_f$ Solve for v_{i2} .

39.) $m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2}$ Solve for v_{f2} if $v_{i1} = 0$.

40.) $(F_1 \sin \theta)r_1 + (-F_2 \sin \phi)r_2 = 0$ Solve for r_2 .

41.) $-kx + m(-g) = 0$ Solve for m .

42.) $F_g = G \frac{m_1 m_2}{r^2}$ Solve for r .

43.) $L - L \cos \theta = \frac{v^2}{2}$ Solve for L .

44.) $\frac{mv^2}{R} = G \frac{Mm}{R^2}$. Solve for v .

45.) $T = 2\pi\sqrt{\frac{L}{g}}$. Solve for g .

46.) $\frac{1}{2}mv_f^2 + \frac{1}{2}kx^2 = \frac{1}{2}mv_i^2 + mgh_i$. Solve for x if $v_f = 0$.

47.) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$. Solve for R_T .

Miscellaneous

Directions: Simplify without using a calculator. Remember to show all of your work.

48.) $\frac{1}{4} + \frac{1}{6}$

49.) $\frac{1}{3} + \frac{1}{18}$

50.) Consider $z = \frac{x}{y}$, $c = ab$, $l = m - n$, or $r = \frac{s^2}{t^2}$.

a.) As x increases and y stays constant, z _____.

b.) As y increases and x stays constant, z _____.

c.) As x increases and z stays constant, y _____.

d.) As a increases and c stays constant, b _____.

e.) As c increases and b stays constant, a _____.

f.) As b increases and a stays constant, c _____.

g.) As n increases and m stays constant, l _____.

h.) As l increases and n stays constant, m _____.

i.) If s is tripled and t stays constant, r is multiplied by _____.

j.) If t is doubled and s stays constant, r is multiplied by _____.

Systems of equations

Conceptual Question:

51.) How many equations are needed to solve...?

a.) for 1 unknown variable? _____

b.) for 2 unknown variables? _____

c.) for 3 unknown variables? _____

Use the equations in each problem to solve for the specified variable in the given terms. Simplify.

52.) $F_f = \mu F_N$ and $F_N = mg \cos \theta$. Solve for μ in terms of F_f , m , g , and θ .

53.) $F_1 + F_2 = F_T$ and $F_1 \cdot d_1 = F_2 \cdot d_2$. Solve for F_1 in terms of F_T , d_1 , and d_2 .

54.) $F_c = ma_c$ and $a_c = \frac{v^2}{r}$. Solve for r in terms of F_c , m , and v .

55.) $T = 2\pi \sqrt{\frac{L}{g}}$ and $T = \frac{1}{f}$. Solve for L in terms of π , g , and f .

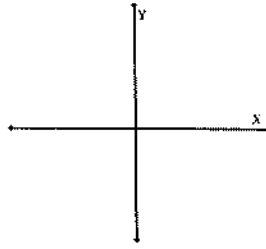
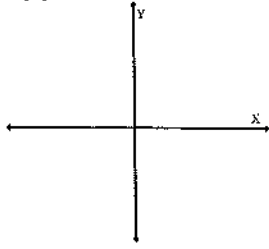
Graphing Equations

56.) If $r = c - x \cdot t$ was graphed on an r vs. t graph, what would the following be?

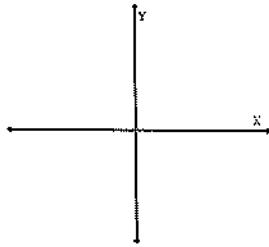
Slope: _____ y-intercept: _____

57.) On the y vs. x graphs below, sketch the relationships given.

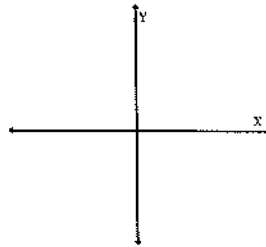
a.) $y = mx + b$, if $m > 0$ and $b = 0$. b.) $y = mx + b$, if $m < 0$ and $b > 0$.



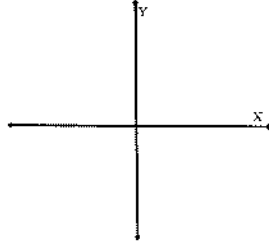
c.) $y = x^2$



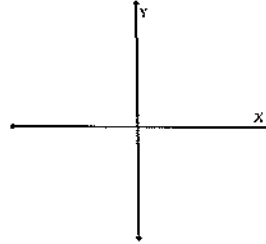
d.) $y = \sqrt{x}$



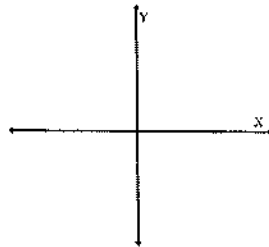
e.) $y = 1/x$



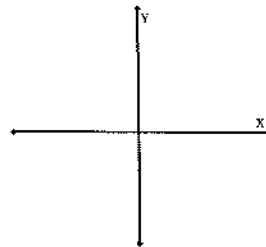
f.) $y = 1/x^2$



g.) $y = \sqrt{\frac{1}{x}}$



h.) $y = \sin(x)$



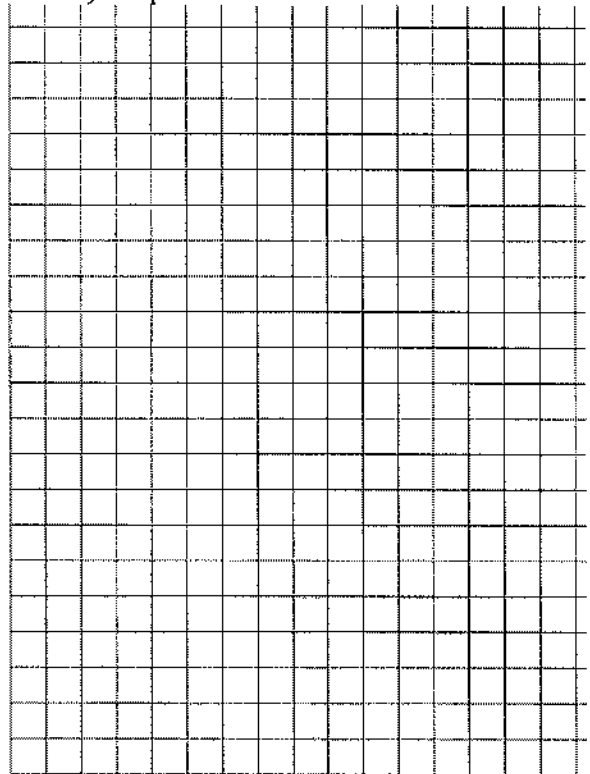
Marbles in Cylinder Lab

You received a graduated cylinder with three identical marbles and an unknown amount of water already in it. You placed extra identical marbles in the cylinder and obtained the data below. Use the data to graph a best-fit line showing the relationship between the water level and the number of marbles. The y-intercept should be visible on the graph. Label your axes and include units.

From the graph, determine a mathematical formula for the water level for any number of marbles. Lastly, give an explanation of your formula in words. Make sure to give an explanation of the slope and y-intercept of your formula.

| Number of Marbles in Water | Water level (mL) |
|----------------------------|------------------|
| 3 | 58 |
| 4 | 61 |
| 5 | 63 |
| 6 | 65 |
| 7 | 68 |

58.) Graph below



59.) Formula: _____

60.) Explanation of the formula in words: (Include the meaning of the slope and y-intercept.)