

## AP Physics 1 Summer Work 2018

The exercises below are a review of the prerequisite math skills that you need to succeed in AP Physics 1. Make sure to read all directions throughout the packet. All work must be completed on the pages below in the area provide. Calculators should not be used. Final answers can be in fractions and in terms of mathematical constants ( $\pi$ ,  $e$ ,  $i$ , etc.).

Your work must be legible and linear, and I must be able to follow it easily. Please no incoherent jumping around the page. Mark your final answers by either circling or boxing them.

Your completed summer work is due the first day of class. A 10% bonus on the assignment will be given to the students who turn in their assignment to the main office of the school by Thursday, July 26th. Office hours are from 8 am – 1:30 pm.

Do not copy work from another student for your own integrity and for your own benefit because all AP Physics 1 students will take a quiz with problems similar to (if not exactly like) those found on this review the first week of school. No calculators will be allowed. You must score a 90% or better on the quiz. Use a math book or INTERNET for reference. No physics is needed for this packet. If you have difficulty, please do not hesitate to email me at MC.

**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.)  $\pi$       Answer: \_\_\_\_\_

c.) 206,000      Answer: \_\_\_\_\_

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

2.)  $(5.0 \times 10^{-8})(2.9 \times 10^2)$

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		
$\mu$		
m		
c	centi	$10^{-2}$
k		
M		
G		

7.) 16.7 kilograms is how many grams?

8.) 560 nm is how many meters?

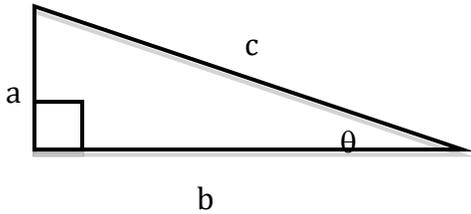
9.) 15 years is how many seconds?

10.)  $8.99 \times 10^9$  seconds is how many years?

11.)  $2.998 \times 10^8$  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  $\theta$ .

15.) Find  $b$  if given  $a$  and  $\theta$ .

16.) Find  $c$  if given  $b$  and  $\theta$ .

17.) Find  $\theta$  if given  $b$  and  $c$ .

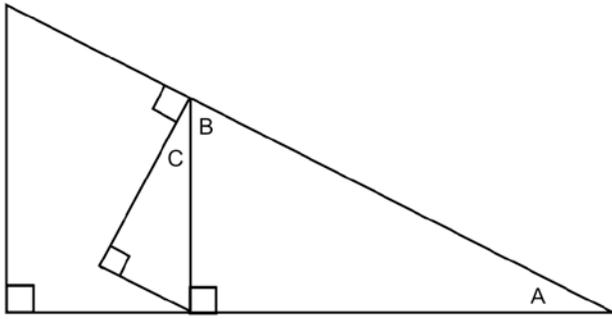
18.) Find  $\theta$  if given  $a$  and  $b$ .

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.

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

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  $d_i = d_f$ .

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

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

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

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

$$35.) \quad mg \sin \theta = \mu mg \cos \theta. \text{ Solve for } \theta.$$

$$36.) \quad \frac{1}{2} m v_f^2 + m g h_f = \frac{1}{2} m v_i^2 + m g h_i$$

A.) Solve for  $h_f$ , if  $h_i = 0$  and  $v_f = 0$ .

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

$$37.) \quad Ft = m v_f - m v_i. \text{ Solve for } v_f.$$

$$38.) \quad m_1 v_{i1} + m_2 v_{i2} = (m_1 + m_2) v_f. \text{ Solve for } v_{i2}.$$

$$39.) \quad m_1 v_{i1} + m_2 v_{i2} = m_1 v_{f1} + m_2 v_{f2}. \text{ Solve for } v_{f2} \text{ if } v_{i1} = 0.$$

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.

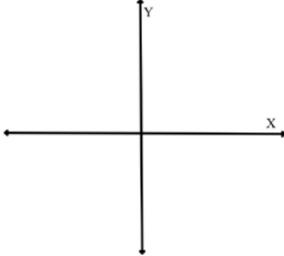
52.)  $F_f = \mu F_N$  and  $F_N = mg \cos \theta$ . Solve for  $\mu$  in terms of  $F_f$ ,  $m$ ,  $g$ , and  $\theta$ .53.)  $F_1 + F_2 = F_T$  and  $F_1 \cdot d_1 = F_2 \cdot d_2$ . Solve for  $F_1$  in terms of  $F_T$ ,  $d_1$ , and  $d_2$ .54.)  $F_c = ma_c$  and  $a_c = \frac{v^2}{r}$ . Solve for  $r$  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  $\pi$ ,  $g$ , and  $f$ .

### Graphing Equations

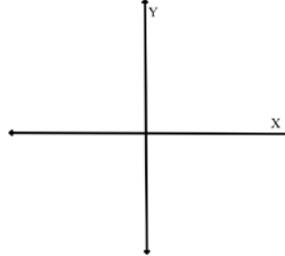
56.) If  $r = c - x*t$  was graphed on an  $r$  vs.  $t$  graph, what would the following be?  
 Slope: \_\_\_\_\_ y-intercept: \_\_\_\_\_

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

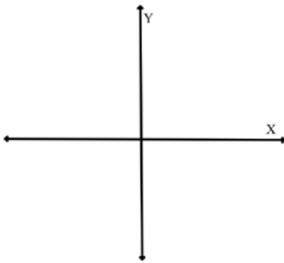
a.)  $y = mx + b$ , if  $m > 0$  and  $b = 0$ .



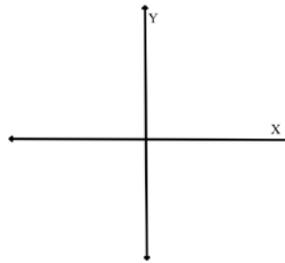
b.)  $y = mx + b$ , if  $m < 0$  and  $b > 0$ .



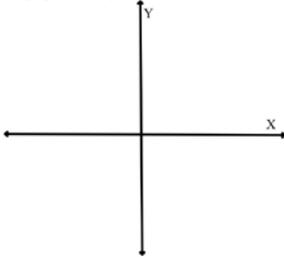
c.)  $y = x^2$



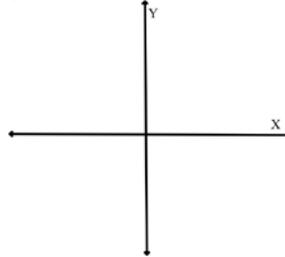
d.)  $y = \sqrt{x}$



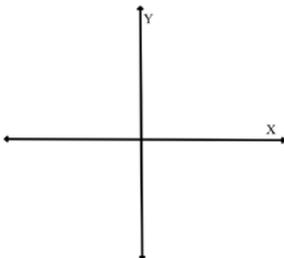
e.)  $y = 1/x$



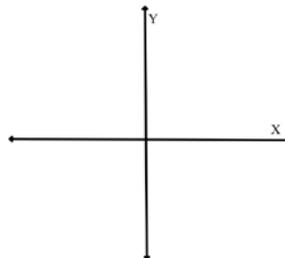
f.)  $y = 1/x^2$



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



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



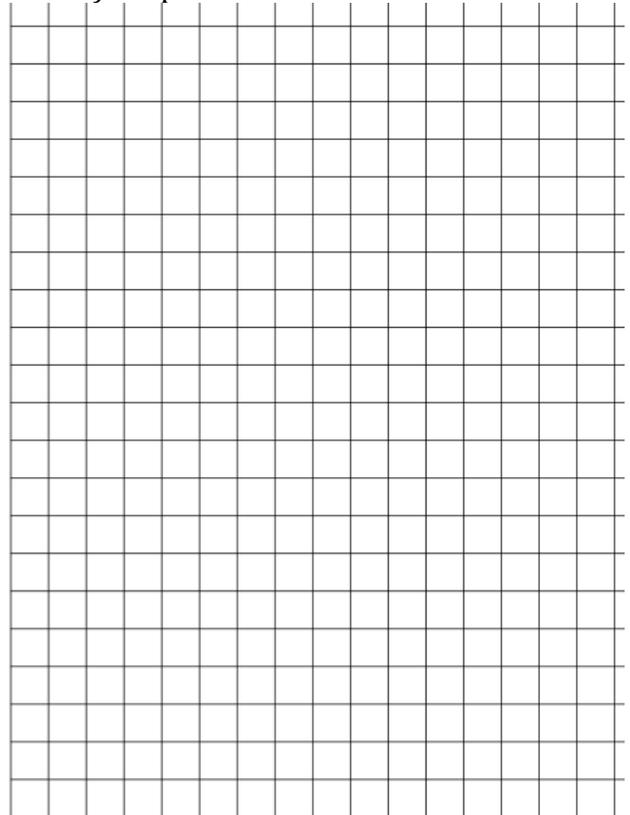
### Marbles in Cylinder Lab

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.)