

## AP Physics 1 Summer Work 2017

Ms. Steele

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. Show all work on a separate sheet of paper. 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. 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.

After completing this packet you should have no problem scoring a 90% or higher. There is no physics is needed to complete this packet. In the pages that follow you will find review questions on the math prerequisites for this class. If you do not know how to complete a section, do not worry. This does not mean that you are not cut out for AP Physics, just that you may need additional practice on a particular math skill. Links throughout the packet are provided to help you with certain math skills.

[http://www.applusphysics.com/courses/ap-1/AP1\\_Physics.html](http://www.applusphysics.com/courses/ap-1/AP1_Physics.html)

<https://sites.google.com/site/fregaphysics/physics/math-review>

<http://www.physicsphenomena.com/PhysicsMathReview.htm>

If you need additional help beyond the links provided please do not hesitate to email me at [hsteele@egusd.net](mailto:hsteele@egusd.net).

### Section 1. 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: \_\_\_\_\_

Review for sig figs - [https://www.physics.uoguelph.ca/tutorials/sig\\_fig/SIG\\_fig.htm](https://www.physics.uoguelph.ca/tutorials/sig_fig/SIG_fig.htm)

Directions: Find the following. Final answers should be in scientific notation with the correct number of significant figures. Do not use a calculator, show all work.

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

## Section 2. Unit Conversions Review

6.) Finish the SI prefix table below. Follow the example of the centi- prefix. You will need to memorize these. Review for SI prefixes: <http://physics.nist.gov/cuu/Units/prefixes.html>

Symbol	Name	Numerical Equivalent
n		
$\mu$		
m		
c	centi	$10^{-2}$
k		
M		
G		

Directions for 7-11: Use whatever method in chemistry that you learned to complete the following conversions. Here is an example:

$$1 \text{ mile} = 5,280 \text{ ft} \quad 1 \text{ ft} = 12 \text{ in} \quad 1 \text{ in} = 2.54 \text{ cm}$$

$$\frac{2.3 \cancel{\text{miles}}}{1} * \frac{5,280 \cancel{\text{ft}}}{1 \cancel{\text{mile}}} * \frac{12 \cancel{\text{in}}}{1 \cancel{\text{ft}}} * \frac{2.54 \text{ cm}}{1 \cancel{\text{in}}} = 370,000 \text{ cm}$$

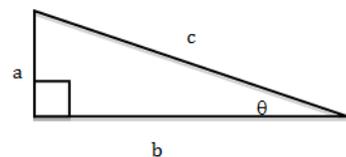
- 7.) 16.7 kilograms is how many grams?
- 8.) 560 nm is how many meters?
- 9.) 15 years is how many seconds?
- 10.)  $8.99 \times 10^9$  seconds is how many years?
- 11.)  $2.998 \times 10^8$  m/s is how many kilometers per hour?

## Section 3. Trigonometry Review (Pythagorean theorem and SOH-CAH-TOA)

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

Review for trig -- <https://www.khanacademy.org/math/trigonometry/trigonometry-right-triangles>

- 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.) Complete the table below without using a calculator. Leave answers as fractions. Draw a  $30^\circ$ ,  $45^\circ$ , and  $60^\circ$  triangle as well.

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

23.) 360 degrees = \_\_\_\_\_ radians.

24.) 4.5 revolutions = \_\_\_\_\_ radians.

25.) Find the length of an arc with a radius of 6.0 m swept across 2.5 radians. Review video for arc length -- <https://www.youtube.com/watch?v=GnvyUNKNUEg>

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

## Section 4. Algebra Review

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

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

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

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

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

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

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

A.) Solve for  $v_i$ .

B.) B.) Solve for  $d$ .

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

A.) Solve for  $v_o$ .

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

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

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

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

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

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

33.)  $mgsin\theta = mmgcos\theta$ . Solve for  $\theta$ .

34.)  $\frac{1}{2}mv_f^2 + mgh_f = \frac{1}{2}mv_i^2 + mgh_i$

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

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

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

36.)  $m_1v_{i,1} + m_2v_{i,2} = (m_1 + m_2)v_f$ . Solve for  $v_{i,2}$ .

37.)  $m_1v_{i,1} + m_2v_{i,2} = m_1v_{f,1} + m_2v_{f,2}$ . Solve for  $v_{f,2}$  if  $v_{i,1} = 0$ .

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

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

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

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

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

43.)  $T = 2\rho \sqrt{\frac{L}{g}}$ . Solve for  $g$ .

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

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

## Section 5. Miscellaneous

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

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

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

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

- As  $x$  increases and  $y$  stays constant,  $z$  \_\_\_\_\_.
- As  $y$  increases and  $x$  stays constant,  $z$  \_\_\_\_\_.
- As  $x$  increases and  $z$  stays constant,  $y$  \_\_\_\_\_.
- As  $a$  increases and  $c$  stays constant,  $b$  \_\_\_\_\_.
- As  $c$  increases and  $b$  stays constant,  $a$  \_\_\_\_\_.
- As  $b$  increases and  $a$  stays constant,  $c$  \_\_\_\_\_.
- As  $n$  increases and  $m$  stays constant,  $l$  \_\_\_\_\_.
- As  $l$  increases and  $n$  stays constant,  $m$  \_\_\_\_\_.
- If  $s$  is tripled and  $t$  stays constant,  $r$  is multiplied by \_\_\_\_\_.
- If  $t$  is doubled and  $s$  stays constant,  $r$  is multiplied by \_\_\_\_\_.

## Section 6. Systems of equations

Conceptual Question:

49.) How many equations are needed to solve...

- for 1 unknown variable? \_\_\_\_\_
- for 2 unknown variables? \_\_\_\_\_
- for 3 unknown variables? \_\_\_\_\_

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

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

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

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

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

## Section 7. Graphing and Line of Best Fit: 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.

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

- 54.) Use the data to graph (on graph paper) 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. Link to review how to draw a line of best fit → [https://learnzillion.com/lesson\\_plans/6933-write-an-equation-for-line-of-best-fit](https://learnzillion.com/lesson_plans/6933-write-an-equation-for-line-of-best-fit)  
Tool you may find useful to do line of best fit using computer → <https://plot.ly/how-to-create-a-line-of-best-fits/>
- 55.) From the graph, determine a mathematical formula ( $y=mx + b$ ) for the water level for any number of marbles.
- 56.) Lastly, give an explanation of your formula in words.
- Explain what the slope represents.
  - Explain what the y intercept represents.

