

## AP/ECE Physics 2020-2021 Summer Packet Assignment

Welcome to AP/UCONN ECE Physics!!!! I'm not going to sugarcoat it. It's going to be a challenging journey ahead, but I'm devoted to making it exciting and worthwhile, and I assure you that this course will prepare you for the AP exam in May. In fact, we usually complete the content covered on the AP exam in early February. **In taking this course, it is expected that you take the AP exam regardless of enrollment in ECE.**

The exercises below are a review of the prerequisite math skills that you need to succeed in AP/ECE Physics. Make sure to read all directions throughout the packet. Final answers can be in fractions and/or in terms of mathematical constants ( $\pi$ ,  $e$ ,  $i$ , etc.). Please circle your final answers. Use any external references you deem necessary for completion **and understanding** of this material.

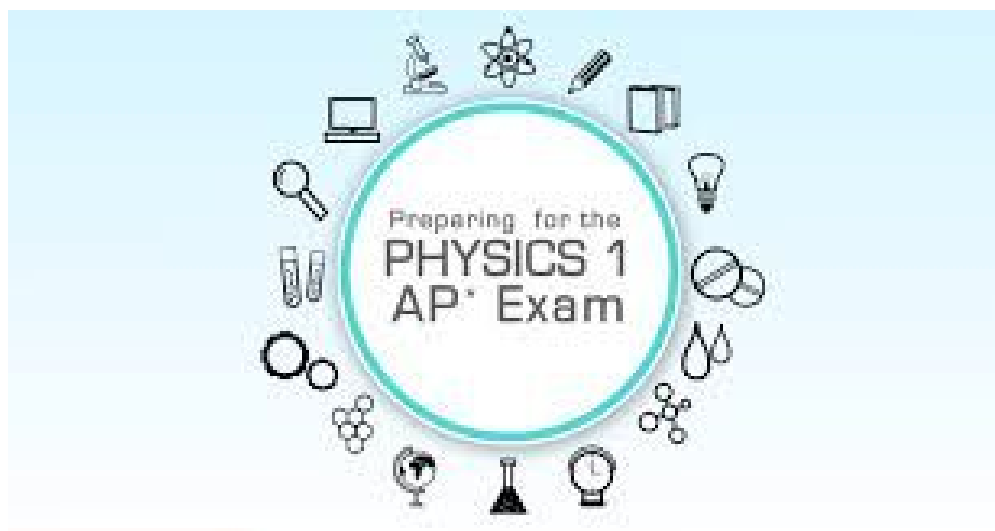
In 2015, the head grader for the AP physics test stated that "Basic algebra was often weak". These problems are examples of what College Board considers basic algebra, and can be solved with only the knowledge of Algebra 1, Geometry and Chemistry. Very little class time will be devoted to reteaching these concepts, so any gaps will have to be covered outside of class during your own time or in extra help sessions with me.

Your work must be legible and linear, and I must be able to follow it easily. Please no incoherent jumping around the page.

### **Your completed summer work is due the first day of class.**

You may work on this with other students from this years AP/ECE physics class, but do NOT simply copy work from another student for your own integrity and for you own benefit because all AP physics students will take a quiz with problems similar to (if not exactly like) those found on this review the first week of school.

**During the summer, if you have questions you can email me at [mrecore@berlinschools.org](mailto:mrecore@berlinschools.org). I will check my email usually once/day, so I should be able to get back to you quickly. Please however, don't wait until the last week of August in case you do have questions.**



## A). Summer Learning Assignment

Physics is all about the motion of objects and how they interact with other objects while in this motion. We will be using a Free Online Textbook for AP/ECE Physics called “College Physics for AP Courses” this year which can be found by going to <http://tinyurl.com/BHS-APPhysics-2020>.

Once there click on the ‘contents’ tab.

You should peruse, and take notes on **chapter 1** - with a heavy focus on *section 1.2 and 1.3*, Do the same for **Chapter 2, but only sections 2.1 through 2.3**.

Your notes should use no more than 4 pages in your notebook in total (otherwise you are writing too much).

You should include **definitions, key ideas, and sample problems** among other information you deem necessary.

## B). Summer Task

1. Go to <https://flipgrid.com/c87b1f32> and create a video to tell me about yourself and your worries about this year as it comes to AP Physics. Be brutally honest. Include information about what I can do to ease your trepidation. Please complete this early so that on the first day of class I can already feel like I know some of you. (This will only be seen by me - others will not be able to see your submission).

## C). Summer Math Practice

- See next pages and complete the packet outlining basic math skills we will be using on a routine basis. These problems should become second nature to you. You may work on this sheet, or on a separate sheet(s) of paper.

NAME: \_\_\_\_\_

### 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 (please SHOW your steps in conversion and show how units cancel)

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?

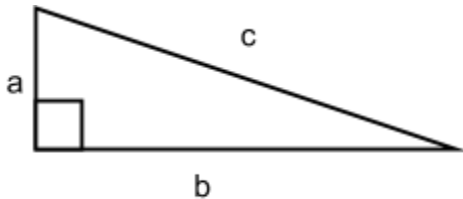
9.) 15 years is how many seconds?

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. (for 12 through 18, write an equation using only the variables given in the problem - for 19-21, solve)



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

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

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

## Algebra Review

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

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

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

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

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

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

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

A.) Solve for  $v_f$ .

B.) Solve for  $d$ .

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

A.) Solve for  $v_o$ .

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

29.) Consider the following equation determine how the conditions will alter the result. a) is done for you as an example.

$$r = \frac{s^2}{t^2}.$$

- a.) As  $s$  is increased and  $r$  stays constant,  $t$  must increase
- b.) If  $s$  is tripled and  $t$  stays constant,  $r$  is multiplied by \_\_\_\_\_. (give a #)
- c.) If  $t$  is doubled and  $s$  stays constant,  $r$  is multiplied by \_\_\_\_\_. (give a #)

### Systems of equations

Conceptual Question:

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

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

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

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

## Marbles in Cylinder Lab Assignment

You receive 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

48.) Formula: \_\_\_\_\_

49.) Detailed explanation of the formula in words: (Include the **meaning** of the slope and y-intercept.)

