AP Physics 1 Summer Assignment 2019 due: August 14, 2019

The AP Physics 1 course is targeted as equivalent to a one-semester college course in algebra-based physics. Topics included in AP Physics 1 include kinematics; dynamics; momentum; work, energy, and power; rotation; oscillations; gravity; mechanical waves; and basic electric circuits.

Our goal is to provide an opportunity for students to develop a deeper understanding of the underlying foundational concepts in physics as well as the skills and practices necessary to treat physics as a science activity instead of a body of knowledge, better preparing students for success in further coursework as well as careers in science and engineering.

The AP Physics 1 Curriculum centers around the six Big Ideas and you will need not only to know but also understand how they all relate:

Big Idea 1: Objects and systems have properties such as mass and charge. Systems may have internal structure.
Big Idea 2: Fields existing in space can be used to explain interactions.
Big Idea 3: The interactions of an object with other objects can be described by forces. Big Idea 4: Interactions between systems can result in changes in those systems.

Big Idea 5: Changes that occur as a result of interactions are constrained by conservation laws.
Big Idea 6: Waves can transfer energy and momentum from one location to another without the permanent transfer of mass and serve as a mathematical model for the description of other phenomena.

Download OpenStax AP College Physics iBook: https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/APCollegePhysics-OP.pdf

Recommended Review Books:

Barron's AP Physics 1, 5th edition by Greg Jacobs

Cracking the AP Physics 1 Exam (2017 Edition) – The Princeton Review

- AP Physics was designed by a select group of college professors and high school science teachers to be equivalent to an introductory college physics course. Visit the College Board site below to explore what an AP Physics 1 course is like:
  - https://apstudent.collegeboard.org/apcourse/ap-physics-1/course-details

- **Complete the Mathematical Review** packet. Because AP Physics 1 is an introductory college level course it is necessary that you come armed with some concept development and problem solving in algebra and trigonometry.

This packet is designed to help you review and to test these skills. Please complete the entire review over the summer. 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 to do a little more review on that topic. Here is a link to the packet:

- Below are just a few websites you can visit to help review:
  - http://www.aplusphysics.com/courses/ap-1/AP1_Physics.html

    http://www.bozemanscience.com/ap-physics/

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

PART I. SOLVING EQUATIONS

Solve the following equations for the quantity indicated.

1. Often problems on the AP exam are done with variables only. Below are various physics formulas. Don't worry about what the variables mean. Just solve for the variable indicated. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers.

a. $v^2 = v_o^2 + 2a(s - s_o)$, $a =$

b. $K = \frac{1}{2}kx^2$, $x =$

c. $T_p = 2\pi\sqrt{\frac{\ell}{g}}$, $g =$

d. $F_g = G\frac{m_1 m_2}{r^2}$, $r =$

e. $mgh = \frac{1}{2}mv^2$, $v =$

f. $x = x_o + v_o t + \frac{1}{2}at^2$, $t =$

g. $B = \frac{\mu_o}{2\pi}\frac{I}{r}$, $r =$

h. $x_m = \frac{m\lambda L}{d}$, $d =$

i. $pV = nRT$, $T =$

j. $\sin\theta_c = \frac{n_1}{n_2}$, $\theta_c =$

k. $qV = \frac{1}{2}mv^2$, $v =$

l. $\frac{1}{f} = \frac{1}{s_o} + \frac{1}{s_i}$, $s_i =$

PART III. FACTOR-LABEL METHOD FOR CONVERTING UNITS (Dimensional Analysis)

A very useful method of converting one unit to an equivalent unit is called the **factor-label method** of unit conversion. You may be given the speed of an object as 25 **km/h** and wish to express it in **m/s.** To make this conversion, you must change **km** to **m** and **h** to **s** by multiplying by a series of factors so that the units you do not want will cancel out and the units you want will remain. Conversion: 1000 **m** = 1 **km** and 3600 **s** = 1 ***h***,

$$\left(\frac{25\text{ km}}{\text{h}}\right)\left(\frac{1000\text{ m}}{1\text{ km}}\right)\left(\frac{1\text{ h}}{3600\text{ s}}\right)=$$

What is the conversion factor to convert km/h to m/s?

What is the conversion factor to convert m/s to km/h?

Carry out the following conversions using the factor-label method. Show all your work!

1. How many seconds are in a year?

2. Convert 28 km to cm.

3. Convert 45 kg to mg.

4. Convert 85 cm/min to m/s.

5. Convert the speed of light, $3x10^8$ m/s, to km/day.

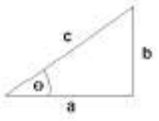
6. Convert 823 nm to m

7. 8.5 cm^3 to m^3

PART IV. TRIGONOMETRY AND BASIC GEOMETRY

Solve for all sides and all angles for the following triangles. Show all your work.

Example: *SOH CAH TOA*



$\sin\theta = \frac{opp}{hyp}$ $\cos\theta = \frac{adj}{hyp}$ $\tan\theta = \frac{opp}{adj}$

Your calculator must be in **degree** mode! **Show all your work.**

1. $\theta = 55°$ and $c = 32$ m, solve for a and b

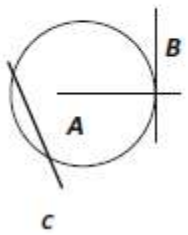
2. $\theta = 45°$ and $a = 15$ m/s, solve for b and c.

3. $b = 17.8$ m and $\theta = 65°$, solve for a and c.

4. Line ***B*** touches the circle at a single point. Line ***A*** extends through the center of the circle.

What is line ***B*** in reference to the circle?

How large is the angle between lines ***A*** and ***B***?

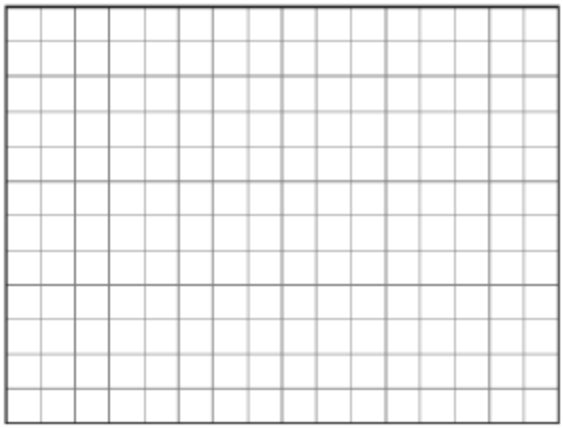


PART V. GRAPHING TECHNIQUES

Graph the following sets of data using proper graphing techniques.

The first column refers to the *y*-axis and the second column to the *x*-axis

1. Plot a graph for the following data recorded for an object falling from rest:



Velocity (ft/s)	**Time** (s)
32	1
63	2
97	3
129	4
159	5
192	6
225	7

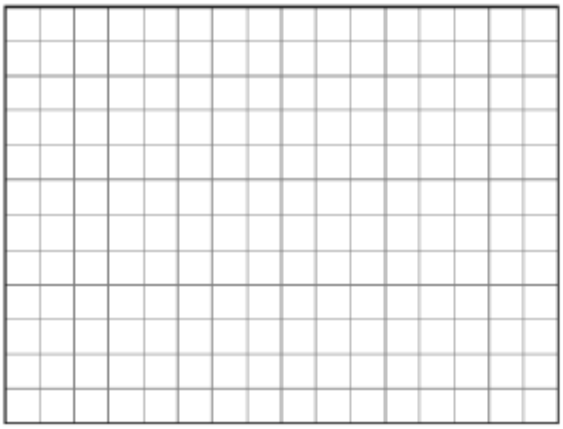
a. What kind of curve did you obtain?

b. What is the relationship between the variables?

c. What do you expect the velocity to be after 4.5 s?

d. How much time is required for the object to attain a speed of 100 ft/s?

2. Plot a graph showing the relationship between frequency and wavelength of electromagnetic waves:



Frequency (kHz)	Wavelength (m)
150	2000
200	1500
300	1000
500	600
600	500
900	333

a. What kind of curve did you obtain?

b. What is the relationship between the variables?

c. What is the wavelength of an electromagnetic wave of frequency 350 Hz?

d. What is the frequency of an electromagnetic wave of wavelength 375 m?