AP Physics 1 Summer Assignment 2025

The summer assignment is due the first day of school

Introduction

Welcome AP Physics 1. AP classes are taught as college courses. This means that:

- I will do as much as I can to *help* you learn, but you and you alone are responsible for learning and understanding everything covered in class.
- I will give you assignments and fair warning about due dates and test dates, but I will not chase after you. If you were absent and you need to turn in an assignment late, *you* need to find out about the assignment. Do not assume I will ask you for it.
- If you're having trouble with something, *you* need to be proactive about learning it, either by coming in for help, consulting with your classmates, or by getting outside help from somewhere else. This expectation is effective *immediately*, starting with this summer assignment. Remember, *your* job is to succeed; my job is to do everything in my power to *help* you be successful, but I can only do my job to the extent that you do yours.

The AP Physics 1 exam does not test whether you know the relevant physics concepts and equations but how well you can apply them to complex problems and situations. It is more than just memorizing and using formulas. You will need to learn how to approach and solve complex problems in multi-step methodical ways. For this reason, AP Physics may seem like the hardest class you have ever faced. But these are all good things!

About the Summer Assignment:

The goals of this assignment are to give you an introduction to the kinds of thinking you need for AP Physics 1. Use a math book or the internet for reference. *No physics is needed for this packet*. The assignment consists of 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

If you have difficulty, please do not hesitate to email me at shruti_chugh@mcpsmd.org

Necessary Supplies for AP Physics 1

- **Notebook**
- **Any scientific calculator**

II. Unit and Metric Conversions and Dimensional Analysis

Metric prefixes are used in front of fundamental measurements in order to show the size (magnitude) of the measurement. Prefixes are put in front of measurements as meters (m), seconds (s), watts (W), hertz (Hz), or grams (g). You MUST know the highlighted prefixes and conversions by heart!

Science uses the ***KMS*** system (***SI***: System Internationale). ***KMS*** stands for kilogram, meter, second. These are the units of choice of physics. The equations in physics depend on unit agreement. You must convert to ***KMS*** to arrive at the correct answer. What if you don't know the conversion factors? Hint: Try a good dictionary and look under "measure" or "measurement". Or the Internet?

Prefix Name	Prefix Symbol	Prefix Meaning	Prefix Translation
Tera	T	10^{12}	Trillion
Giga	G	10^{9}	Billion
Mega	M	10^{6}	Million
kilo	k	10^{3}	Thousand
hecto	h	10^{2}	Hundred
deca	da	10^{1}	Ten
deci	d	10^{-1}	tenth
centi	c	10^{-2}	hundredth
milli	m	10^{-3}	thousandth
micro	μ	10^{-6}	millionth
nano	n	10^{-9}	billionth

Convert the following prefixed measurements into correct scientific notation form (only one digit to the left of the decimal point). The easiest way to do this is to simply take the prefix out and replace it with its numerical value. In the following example, G = 10^9

Example: 3.5 GW = 3.5 x 10^9 watts

1) 2.4 ns = _____seconds

2) 3.5 Ms = _____seconds

3) 9.8 μm = _____meters

4) 4.6 Gg = _____grams

5) 7.2 mm = _____meters

6) 5.7 km =_____meters

7) 5.7 cm = _____meters

Rewrite the following numbers as words with appropriate prefixes. Show all your steps.

Example: 43000000 seconds = 43 million seconds = 43 Megaseconds = 43 Ms

8) 9720000000 hertz = _____

9) 0.015 watts = _____

10) 65/1000000 meters = _____

11) 43000 seconds = _____

12) 5.04/100 grams = _____

Convert the following prefixed measurements into correct scientific notation form.

Example: 2500 centimeters = $(2.5 \times 10^{3})(10^{-2})$meters = 2.5×10^{1}meters = 25 meters

13) 4500 kilograms = _____

14) 5/100 micrometers = _____

15) 0.00003 Megaseconds = _____

16) 15,000 milliwatts = _____

17) 75/100,000 centimeters = _____

Table of Weights and Measures		
Length	Area	Volume

1 nautical mile = 6076.12 feet 1 inch = 2.54 cm 1 league = 5 280 yards 1 cable = 120 fathoms 1 fathom = 6 feet 1 degree = 69.047 miles 1 mile = 5280 feet 1 hand = 4 inches	1 township = 36 square miles *Derive your area conversion factors by squaring all dimensions* Ex. 12^2 inch^2 = 1^2 foot^2 or 144 square inch = 1 square foot	4 gills = 1 pint 2 pints = 1 quart 1 liter = 1.0567 quarts 1 bushel = 4 pecks = 32 quarts 1 gallon = 4 quarts *Derive your volume conversion factors by cubing all dimensions.*

How do we convert units from one set to an equivalent set? Use Dimensional Analysis, also called the "Factor-label" method!

Example: Convert 198 km/hr to m/s:

$$\frac{198\ \cancel{km}}{1\ \cancel{hr}} \left| \frac{1000\ m}{1\ \cancel{km}} \right| \frac{1\ \cancel{hr}}{60\ \cancel{min}} \left| \frac{1\ \cancel{min}}{60\ s} \right.$$

$$= \frac{198 \times 1000 \times 1 \times 1\ m}{1 \times 1 \times 60 \times 60\ s} = \frac{19800\ m}{3600\ s} = 55\ m/s$$

Notes:

- The units are arranged so as to cancel out; ie, if "meters" is in the numerator, then it would be placed in the denominator of the first conversion step.
- Each conversion step involves a numerator equal to what is in the denominator.

Convert the given unit combinations into the ones requested.

18) Convert 1 year to seconds

19) Convert 450 km/hr to m/s

20) Convert 60mi/hr to m/s (1 mile = 1.609 km)

21) Convert 100 m/s to mi/hr

22) 15 years =_____ s

23) 8.99×10^9 s =_____ years

24) 2.998×10^8 m/s =_____km/hr

25) 4008 g = _____ kg

26) 0.77 m = _____ cm

27) 8.8×10^{-8} m = _____ mm

28) 25.0 μm = _____ m

29) 2.65 mm = _____ m

30) 8.23 m = _____ km

31) How many miles will a person run during a 10 kilometer race?

32) The moon is 250,000 miles away. How many feet is it from earth?

33) Lake Michigan holds 1.3 x 1015 gallons of water. How many liters is this?

34) Sixty miles/ hour is how many ft/sec?

35) If a projectile travels 3.00 x 103 feet in one second, how far will it travel in 18 minutes?

36) A small herd of cattle consumes fourteen bales of hay in two weeks. How many bales will this herd consume in a year?

37) Sixty-two months is equivalent to how many seconds?

38) A car consumes 25.00 gallons of fuel when driving a distance of 400.0 km. How many gallons will it consume when driving 250.0 miles?

39) How many feet per second is a wave going if it travels a distance of one mile in 7.35 seconds?

40) Your cruise ship is leaving for a 610-league adventure. How many nautical miles is this?

41) Later the ship is discovered at 38 fathoms deep underwater. Convert this to meters.

42) If you are rationed to 32 gills of fresh water a day, how many liters is this?

43) To reach the top of a palm tree for a coconut you will have to climb 7.4 m. How many hands is this?

44) 16.0 grams of food contain 130 calories. How many grams of food would you need in order to consume 2150 calories?

45) The cost of 1.00 L of gas is 26.9 cents. How many dollars will 12.0 gallons cost?

46) Light travels 186 000 miles/s. How long is a light year in meters? (1 light year is the distance light travels in one year)

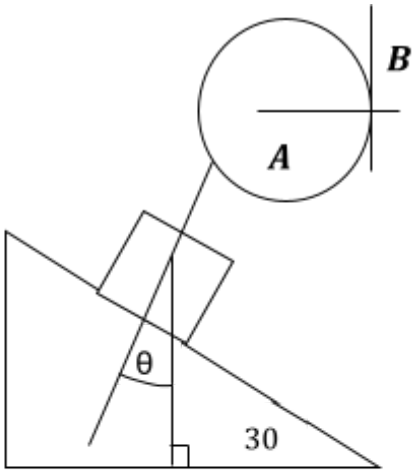
III. Trigonometry and Geometry Review

Solve the following geometric problems.

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

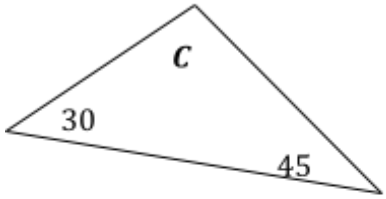
1) What type of line is line B in reference to the circle? _____

2) How large is the angle between lines A and B? _____



3) What is angle C? _____

4) What is angle θ ? _____

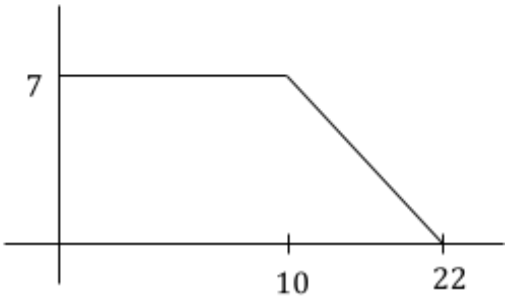


The radius of a circle is 5.5 cm,

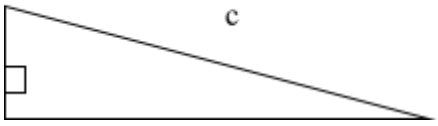
5) What is the circumference in meters? _____

6) What is its area in square meters? _____

7) What is the area under the curve (function) at the right? _____



Pythagorean Theorem - for any right triangle, $a^2 + b^2 = c^2$, where:



Find the unknown quantities for each right triangle given the information below.

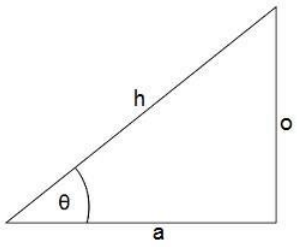
8) a = 9, b = 9, c = _____

9) a = 4, b = _____, c = 12

10) a = _____, b = 10, c = 13

Basic Trigonometry: Using Sine, Cosine, and Tangent for any right triangle.

$$\text{Sin}(\theta) = \frac{\text{opp}}{\text{hyp}} \; ; \; \text{Cos}(\theta) = \frac{\text{adj}}{\text{hyp}} \; ; \; \text{Tan}(\theta) = \frac{\text{opp}}{\text{adj}}$$



Using the generic triangle to the right, Right Triangle Trigonometry and the Pythagorean Theorem, solve the following. Your calculator must be in degree mode.

11) $\theta = 55^o$ and c = 32 m, solve for a and b._____

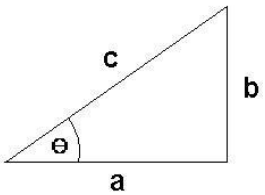
12) $\theta = 45^o$ and a = 15 m/s, solve for b and c._____

13) b = 17.8 m and $\theta = 65^o$, solve for a and c. _____

14) a = 250 m and b = 180 m, solve for θ and c. _____

15) a =25 cm and c = 32 cm, solve for b and θ._____

16) b =104 cm and c = 65 cm, solve for a and θ._____



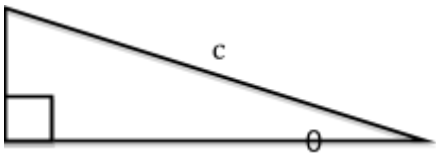
Use the figure below to answer the following problems. Simplify as much as you can.

17) Find c if given a and b.

18) Find a if given b and c.

19) Find a if given c and θ. a

20) Find b if given a and θ.



b

21) Find c if given b and θ.

22) Find θ if given b and c.

23) Find θ if given a and b.

24) If a = 2.0 and c = 7.0, what is b?

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

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

Systems of equations Conceptual Questions:

1) 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.

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

b) $F_1 + F_2 = F_T$ 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.

IV. Algebra Review

Formula Manipulation: Some of the most difficult problems we'll see in this course are those which require implicit manipulation of a formula (solving for one of the variables in terms of the others). Often problems on the AP exam are done with variables only. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers. It is extremely important that you are able to correctly rearrange an equation.

Solve the following relationships for the indicated variable:

1) $v_1 + v_2 = 0$, $v_1 =$ _____

2) $a = \frac{v}{t}$, $t =$ _____

3) $v_f^{\,2} = v_i^{\,2} + 2ax$

   a) $v_i =$ _____

   b) $x =$ _____

4) $K = \frac{1}{2}kx^2$, $x =$ _____

5) $T_p = 2\pi\sqrt{\frac{\ell}{g}}$, $g =$ _____

6) $B = \frac{\mu_o}{2\pi}\frac{I}{r}$, $r =$ _____

7) $x_m = \frac{m\lambda L}{d}$, $d =$ _____

8) $pV = nRT$, $T =$ _____

9) $Ft = mv_f - mv_i$, $v_f =$ _____

10) $m_1v_{i,1} + m_2v_{i,2} = (m_1 + m_2)v_f$, $v_{i,2} =$ _____

11) $\frac{mv^2}{R} = G\frac{Mm}{R^2}$; v = _____

12) $v^2 = v_0{}^2 + 2a(x - x_0)$ a = _____

13) $a_c = \frac{v^2}{r}$; v = _____

14) $mgh = \frac{1}{2}mv^2$; v = _____

15) $x = x_0 + v_0t + \frac{1}{2}at^2$; t = _____

16) $F_g = \frac{Gm_1m_2}{r^2}$; r = _____

17) $\sin\theta = \frac{a}{h}$; h = _____

V. Miscellaneous

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

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

2) $\frac{1}{3} + \frac{1}{18}$

Determine the value of each variable for each set of equations:

3) $x + y = 17$ $x - y = 7$

4) $6x + 7y = 19$ $x + y = 5$

5) $x + 2y - 3z = 5$ $x - y + 2z = -3$
$x + y - z = 2$

Variable Relationships: 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 _____.

Use the equation to predict how one variable affects another variable.

6) In the equation, $F = \frac{GmM}{r^2}$ if *M* increases by 2, what will be the factor of change in F?

7) In the equation, $F = \frac{GmM}{r^2}$ if *r* increases by 2, what will be the factor of change in F?

8) In the equation, $F = \frac{GmM}{r^2}$ if *r* increases by 2, m increases by 2 and M increases by 2, what will be the factor of change in F?

9) In the equation, p = mv if *m* increases by 2, what will be the factor of change in p?

10) In the equation, p = mv if *v* increases by 2, what will be the factor of change in p?

11) In the equation, p = mv if *m* increases by 2, and v increases by 2 what will be the factor of change in p?

VI. Graphing Equations

What is the slope and the y-intercept of the following:

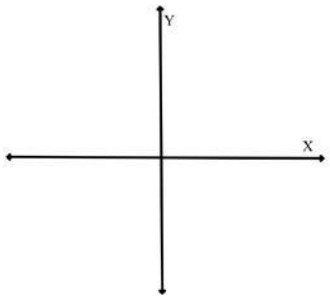
12) $y = -3x + 7$

13) $2y - 6x = 18$

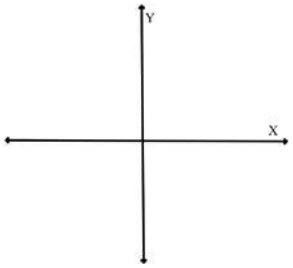
14) Determine the slope of the line passing through the points (5,9) and (3,-1).

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

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



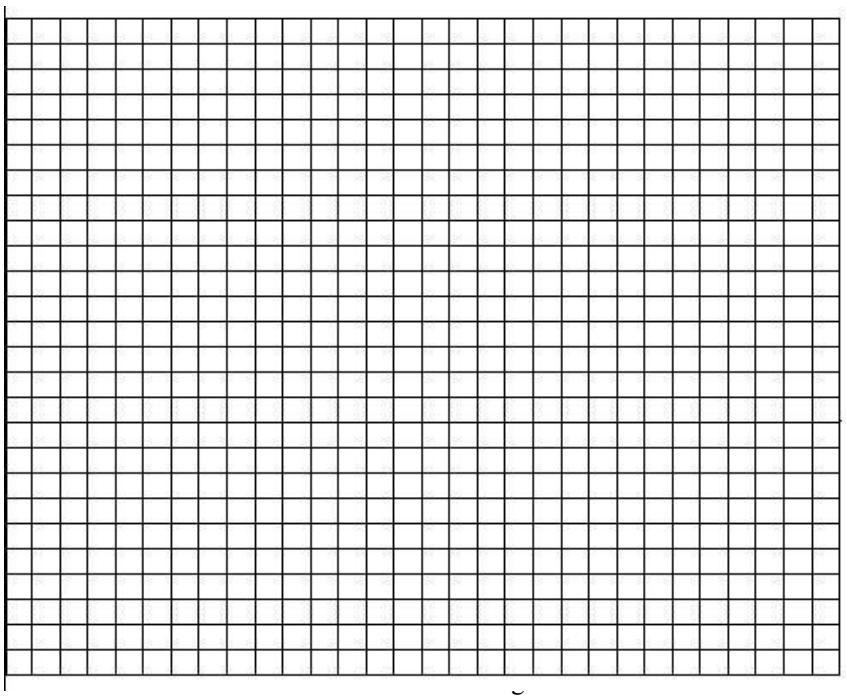
b.) $y = mx + b$, if $m < 0$ and $b > 0$.



Distance is the <u>responding</u> variable and has units of m. Time is the <u>manipulated</u> variable and has units of s

Time (sec)	Distance (m)
0	0
1	4
2	8
3	12
4	16
7	28
8	32

16) Prepare a graph of this data.



17) Using your graph, predict the time to travel 19 m.

18) Using your graph, predict the distance traveled in 9.5 sec.

19) Plot a graph using the following data:

Distance (m)	Time (s)
6.2	1
9.4	2
13.8	3
17.5	4
22.4	5

20) What type of relationship is this?

21) Calculate the slope.

22) Write an equation describing the relationship between d and t.