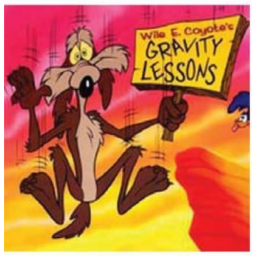
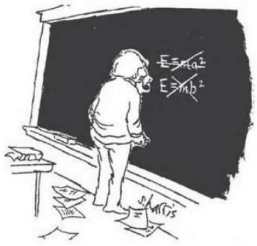
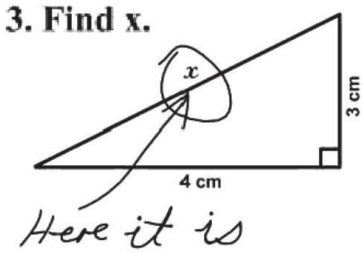
AP Physics 1 Summer Assignment-2018







Welcome to the AP Physics 1 Team!

AP Physics 1 is an introductory college level physics course. Concept development and problem solving are algebra and trigonometry based. If you are interested in engineering or a physics related career and are a Junior, you should consider taking the AP Physics C course next year, which is calculus based.

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The attached assignment is the first of the year and is due in two parts. You must mail these to me over the summer and they must be postmarked by the dates below. Priority mail is not necessary, just have it *postmarked* by the dates given. They will be marked down for being late, so don't mail it late. ☺

First	Parts 1-7: #1-32	July 15
Second	Part 8: #33-50	July 31

Mail to: Mr. Yockey
Bishop O'Connell
6600 Little Falls Rd
Arlington, VA 22213

This is a graded assignment that will count as part of your first quarter grade. Please complete this assignment on 8.5"x11" loose leaf paper. You must show your work and circle your answers.

One answer sheet is provided for each portion that must be mailed. Submit your answer sheet stapled on top of the work pages.

A reference is provided to help you become familiar with some of the basic concepts of physics. If you have questions or get stuck, you can use your text book, www.PhysicsClassroom.com or e-mail me at hyockey@bishopoconnell.org. I won't be on every day, but will be from time to time.

I am really looking forward to working with you next year. Have a nice summer.

-Mr. Yockey

AP Physics Summer Assignment

Answer Sheet 1: Due July 15

Name:_____ Period:_____

Before mailing check the following:

_____ All answer boxes below are filled in and legible.
_____This answer sheet is stapled on top of the work pages.
_____ Work pages are 8.5 x 11 loose leaf paper.
_____ Email hyockey@bishopoconnell.org after mailing.

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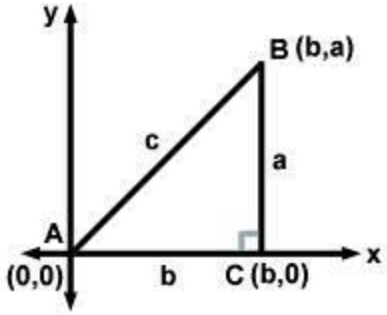
Arlington, VA 22213

1.	**2.**	**3.**	**4.**	**5.**	**6.**
7.	**8.**	**9.**	**10.**	**11.**	**12.**
13.	**14.**	**15.**	**16.**	**17.**	**18.**
19.	**20.**	**21.**	**22.**	**23.**	**24.**
25.	**26.**	**27.**	**28.**	**29**	**30.**
31.	**32.**				

Part 1: Geometry/Trig Review

Consider the right triangle pictured below:



You're familiar with the Pythagorean Theorem.

$$a^2 + b^2 = c^2$$

Using the lengths of the sides of right triangles such as the one above, the trigonometric functions can be defined in the following way:

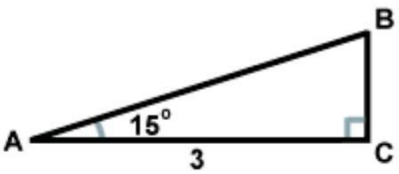
$$\sin(A) = \frac{opposite.side}{hypotenuse} = \frac{a}{c}$$

$$\cos(A) = \frac{adjacent.side}{hypotenuse} = \frac{b}{c}$$

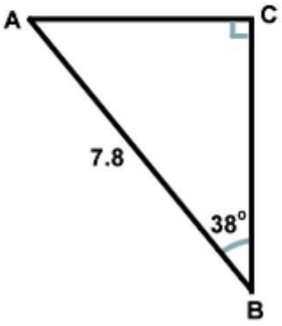
$$\tan(A) = \frac{opposite.side}{adjacent.side} = \frac{a}{b}$$

Determine the unknown length of these triangles using the trig functions and/or the Pythagorean Theorem. Show your work on a separate sheet of paper:

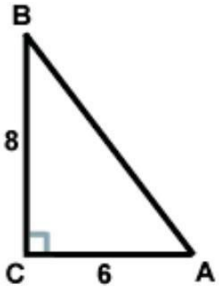
1. Determine AB and BC



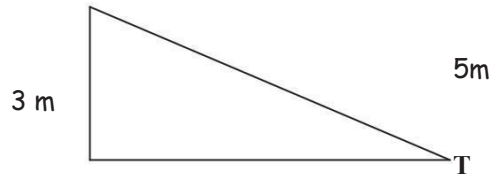
2. Determine AC and BC



3. Determine AB

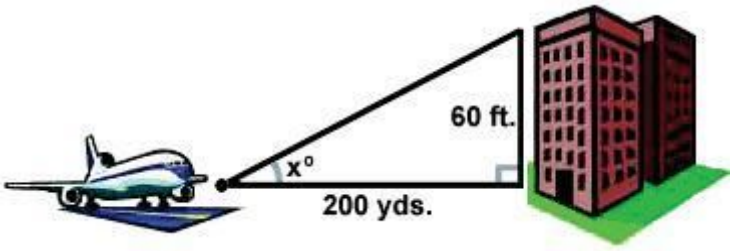


If you need to find an angle, you can use arcsin, arccos and arctan. For instance, if you are given this triangle:

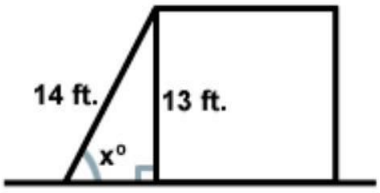


Solve the angle, T. You know that sin T = 3/5, so in your calculator type: 2^{nd} sin, which looks like $\sin^{-1}$, (3/5) and enter. This will give you 36.87 degrees. You can do the same with cos and tan.

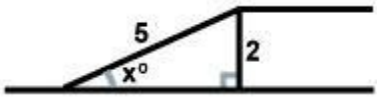
4. An airplane takes off 200. yards in front of a 60. foot building. At what angle of elevation must the plane take off in order to avoid crashing into the building? Assume that the airplane flies in a straight line and the angle of elevation remains constant until the airplane flies over the building. (note the units!)



5. A 14 foot ladder is used to scale a 13 foot wall. At what angle of elevation must the ladder be situated in order to reach the top of the wall?



6. A ramp is needed to allow vehicles to climb a 2.0 foot wall. The angle of elevation in order for the vehicles to safely go up must be 30° or less, and the longest ramp available is 5.0 feet long. Can this ramp be used safely?



Part 2: Quadratic Formula Review
When you have to solve a trinomial, you will often want to use the quadratic formula.

Given a quadratic equation $ax^2 + bx + c = 0$, the solutions are given by the equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Solve the following equations and show your work. If you have the quadratic formula program on your calculator, you may use it to check your work.

7. Solve for x: $3x^2 - 14x + 8 = 0$
8. Solve for x: $4x^2 - 1 = 0$
9. Solve for x: $4x^2 + 28x = -49$
10. Solve for x: $2x^2 + 5x + 4 = 0$

Part 3: Fraction Review
When adding and subtracting fractions, you need to find the lowest common dominator.

Example:

$$\frac{a-b}{ab^2} + \frac{a+b}{a^2b} = \frac{(a-b)\cdot a}{a^2b^2} + \frac{(a+b)\cdot b}{a^2b^2} = \frac{a^2 - ab}{a^2b^2} + \frac{ab + b^2}{a^2b^2} = \frac{a^2 + b^2}{a^2b^2}$$

Try these. Show your work.

11. $\frac{2}{a} + \frac{3}{a-5}$

12. $\frac{2}{x^2 - 36} - \frac{1}{x^2 + 6x}$

13. $\frac{1}{6x} + \frac{2}{3x} - \frac{3}{4x}$

Part 4: Density Review

Density is a measure of stuff per unit space. The one you are most familiar with, mass density, is mass/volume.

Volume of a sphere: $V_{sphere} = \frac{4}{3}\pi \cdot r^3$

Volume of a Cylinder: $V_{cyl} = \pi \cdot r^2 h$

Mass-Volume Density: $\rho = \frac{m}{V}$ where ρ is density

14. An iron sphere has a mass density of $U = 7.86 \times 10^3$ kg/m^3. If the sphere has a radius of 0.5 m, how much mass does the sphere contain?

15. A sphere made out of material x has a mass of 5 kg and has a radius of 4m. How much mass does a sphere of the same material with a 3 m radius have? (hint: since they are the same material, they have the same density)

16. A sphere made out of material y has a mass of 6 kg and has a radius of 3m. How much mass does a cylinder of the same material with a 4 m radius and a 2 m length have?

Part 5: Unit Conversions

I hope that you all have been comfortable going from one unit to another in chemistry and math. We'll need to do this frequently as well as understand *dimensional analysis*. Keep in mind that units just multiply and divide algebraically.

Table 5. SI prefixes

Factor	Name	Symbol	Factor	Name	Symbol
10^{24}	yotta	Y	10^{-1}	deci	d
10^{21}	zetta	Z	10^{-2}	centi	c
10^{18}	exa	E	10^{-3}	milli	m
10^{15}	peta	P	10^{-6}	micro	μ
10^{12}	tera	T	10^{-9}	nano	n
10^{9}	giga	G	10^{-12}	pico	p
10^{6}	mega	M	10^{-15}	femto	f
10^{3}	kilo	k	10^{-18}	atto	a
10^{2}	hecto	h	10^{-21}	zepto	z
10^{1}	deka	da	10^{-24}	yocto	y

The way that I expect you to do conversions is by setting up an algebraic equation. This method is often referred to as the factor label method. There are many examples of this on the internet if you need help with this. However, it is a fundamental skill taught in chemistry and you are expected to have mastered it. For instance, let's say that we want to convert 20 inches to nanometers. Begin with what is given. Then, using a conversion factor, convert and cancel unit until you have the desired unit.

$$20 inches \times \frac{1 meter}{39.37 inches} \times \frac{10e9\ nanometer}{1\ meters} = 5.08 \times 10^8\ nanometers$$

You can see that inches and meters cancel out, leaving us with nanometers.

Use the method of converting units shown on the previous page to determine the following.

17. How many inches are in 48 centimeters?
18. How many centimeters are in 48 inches?
19. How many inches are in 28nm?
20. How many pounds are in 600 newtons?
21. How many meters per second is 25 miles per hour?

You should also know that sometimes we have a unit which is actually a substitution for many units. For example, we know that F = ma. (force = mass x acceleration).

If you've had a prior physical science course, you know that the unit of force is measured in newtons. But, from the equation, F= m·a, we see that the units of force should be the mass unit (kg) multiplied by the acceleration unit (m/s^2).

That means that a newton is actually equal to a $kg \cdot m/s^2$.

Now try figuring out these units.

22. A Joule is a measure of energy. Use both the equations for kinetic energy, KE, and gravitational potential energy, PE to find what is a Joule equal to (in terms of kg, m, & s). KE = $\frac{1}{2}$ $m \cdot v^2$ and PE = $m \cdot g \cdot h$.
23. If momentum = m·v, what is the unit of momentum?
24. Here's a harder one, in terms of newtons (and other units like kg, m, s) solve for what a Joule is.

Part 6: Ratios

Often the relationships of numbers or variables let us understand what these equations mean.

For example, the displacement, x, of a moving object is found by multiplying its speed, v, by the time it moved, $x_1 = v_1 \cdot t$.

If it moves twice as fast, $v_2 = 2v_1$, then it moves twice as far, $x_2 = v_2 \cdot t = 2v_1 \cdot t = 2(v_1 \cdot t) = 2x_1$.

FOLLOW THAT THROUGH CAREFULLY. Maybe rewrite it vertically. We'll do this sort of substitution often.

So let's say that we push a block of mass m with a force of F and it accelerates with a value of a.

25. If we push another block with mass 2m, how much force is needed to have the same acceleration, a?
26. What if we now push a block of mass 3m with a force of 2F. What will the acceleration be? (in terms of a, like 2a, 0.5a, etc)
27. KE = $\frac{1}{2}$ mv^2. How much would the kinetic energy of an object change if it has 3 times the initial velocity?
28. KE = $\frac{1}{2}$ mv^2. How much would the kinetic energy of an object change if it has 4 times the initial velocity and we added on 4 times the mass?

Part 7: Simultaneous Equations

Now let's look at some simultaneous equations (systems of equations). There are a few ways to solve these problems. Take a look at this example:

Solve for x and y:

5x -2y = 15

7x – 5y = 18

Solution 1 You can graph the equations by solving for y. $y = \frac{5x}{2} - \frac{15}{2}$ $y = \frac{7x}{5} - \frac{18}{5}$

The solution is the point of their intersection. Try it out, you should get (3.54, 1.36).

Solution 2 The way that you were first taught to solve systems of equations was probably to do substitution; in one equation, solve for one variable in terms of the other and then substitute it in the other equation. This is most useful for simple equations.

If you solve for y in the first equation, you will get: $y = \frac{5x}{2} - \frac{15}{2}$

Then substituting for y for the second equation, you find x = 3.54.

Then by substituting x in either of the above equations, you can find y =1.36

Check your answer by substituting your answers into the other equation; it should solve both equations.

Solve these problems using **solution method 2 and check your answer.**

29. 5x + y = 13
3x = 15 – 3y

30. 2x + 4y = 36
10y – 5x = 0

31. 2x – 4y = 12

3x = 21 + 6y

32. 10x + 7y = 49
10y – x = 70

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33.	**34.**	**35.**	**36.**	**37.**	**38.**
39.	**40.**	**41.**	**42.**	**43.**	**44.**
45.	**46.**	**47.**	**48.**	**49.**	**50.**

Part 8:Basics Physics Concepts

This web site is a useful reference that will help familiarize you with some of the basic concepts of physics. This will be helpful especially if this AP Physics class is your first physics class. You may also want to explore this as well as other introductory website:
http://www.physicsclassroom.com/Class/

Click on:1-D Kinematics, then click on: b. Scalars and Vectors

Read through this section and answer the following.

33. Which of the following are vectors? List all that apply.
a. 16 mi/hr b. 4 m east c. 47 kg d. 18 s e. 8 m/s^2, up f. 19 km/hr, south

Click on: Distance and Displacement (Still in Lesson 1)

Read through Describing motion in words – Distance and Displacement
Quick Quiz: **Skier**
34. Find the distance traveled from point A to B to C.

35. Find the displacement from A to B to C.

Click on: Speed and Velocity (Still in Lesson 1)

Read through Speed and Velocity

Quick Quiz: **Football coach**

36. Find the average speed from A to B to C.

37. Find the average velocity from A to B to C.

Click on: Acceleration (Still in Lesson 1) **Read through Acceleration**
Click on: The first **ANIMATION** box. You should see a red, green and a blue car.

Answer the 3 questions under the animation.
*Which car or cars (red, green, and/or blue) are undergoing an acceleration?

*Which car (red, green, or blue) experiences the greatest acceleration? _____

*Consider the position-time graph at the right. Each one of the three lines on the position-time graph corresponds to the motion of one of the three cars. Match the appropriate line to the particular color of car.

Click on: Position-time Graphs (located beneath animation)

Read through The meaning of shape of a p-t graph.

Click on: The meaning of slope of a p- t graph (at the bottom of the page) Read through The meaning of slope of a p-t graph.

Draw a position-time graph and a velocity time graph for each of the following cases:
38. A car moves to the right at a constant velocity
39. A car moves to the right at an increasing speed
40. A car moves to the right at a decreasing speed

Click on: The meaning of slope on a v-t graph
Read through The meaning of slope of a v-t graph

Use the graph in **Check your understanding** to answer the questions.

During what time interval is the rocket
41. moving away from its starting position?

42. accelerating positively?
43. not moving?

44. changing direction?
45. slowing down?

Click on: Determining the slope on a v-t graph
Read through Determining slope on a v-t graph

Click on: Determining the area on a v-t graph

Read through Determining area on a v-t graph

Use the graph below to answer the questions.
46. Find the velocity at 2 seconds.

47. Find the position of the object at 4 seconds.
48. Find the acceleration of the object at 6 seconds

49. When is the object accelerating?
50. Find the displacement of the object at 6 seconds.