AP Physics 1: Summer Assignment

Welcome to AP Physics!

Hello! Welcome to AP Physics 1. This course will delve deep into the study of motion, everything from tennis balls to planets to electrons to waves. AP Physics is a fascinating and challenging course that requires a solid foundation in mathematics to be able to study how the world moves. To make sure you have the proper mathematics background please complete the following packet and submit it as you walk into class on the first day of school. On the second day of school you will take the AP Physics 1 entrance exam to make sure that AP Physics 1 is a good fit. The entrance exam will cover the material on this summer assignment and you will need to score higher than an 80% on that to remain in AP Physics 1. Students who score less than an 80% might be better suited in another class. I'm looking forward to meeting you on the first day of school and be sure to check out the helpful links throughout this assignment to get refreshers with the math skills and watch the necessary video for the graphing portion of the assignment.

Sincerely,

Mr. Templin and Dr. Jones

Part 1: Goals for AP Physics

1) What are your goals for AP Physics 1?

2) What topic are you most looking forward to in AP Physics 1?

3) Have a great time with the summer assignment! Show all necessary work in the space provided. Answers without work will be graded as zeros. Draw a stick figure in the space below to confirm that you will show all of your work.

Part 2: Measuring Skills

A ruler will be required for this section of the summer assignment. An AP Physics 1 student should have no problem converting units and measuring objects. Students that can not do common conversions from centimeters to meters in their head are not prepared for AP Physics 1. For now, ignore the uncertainty of your measurements. We'll handle that in class.

1) Find an object and take a picture of it. Email this picture to your teacher (stemplin@htps.us or djones@htps.us) with the subject "AP Physics 1 Summer Assignment Object". The object must be recognizable to an elementary school student. A prize will be given to the AP Physics 1 student who finds the smallest object and largest object.

2) Measure the height of your object in meters. Record this height to the right: _____

3) Convert your measurement to cm.

4) Convert your measurement to μm.

5) Convert your measurement to mm.

6) Convert your measurement to feet.

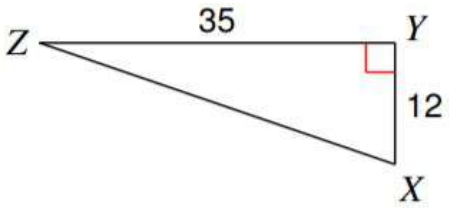
7) Convert your measurement to miles.

8) Estimate the volume of your object.

Part 3: Trigonometry

Trigonometry needs to be a foundational skill in AP Physics 1.

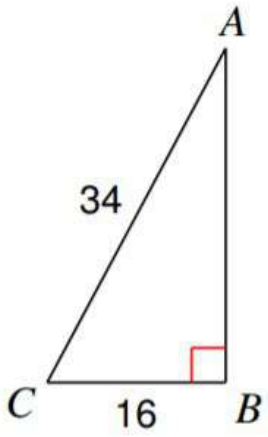
1) Answer the following regarding the triangle to the right, with angles X, Y, and Z.



$\tan(X)$ = _____ $\cos(X)$ = _____ $\sin(X)$ = _____

$\tan(Z)$ = _____ $\cos(Z)$ = _____ $\sin(Z)$ = _____

2) Answer the following regarding the triangle to the right, with angles A, B, and C.



$\tan(A)$ = _____ $\cos(A)$ = _____ $\sin(A)$ = _____

$\tan(C)$ = _____ $\cos(C)$ = _____ $\sin(C)$ = _____

Part 4: Algebraic Skills

Section I

The equation relating the variables T_S, m, and k is shown below.

$$T_S = 2\pi\sqrt{\frac{m}{k}}$$

1) As k approaches infinity, what happens to T_S? Explain.

Example of a Superior Answer: As k gets larger and larger and approaches infinity, T_S gets smaller and smaller and approaches zero. T_S and k have an inverse square relationship, and the square root of $1/\infty$ is zero.

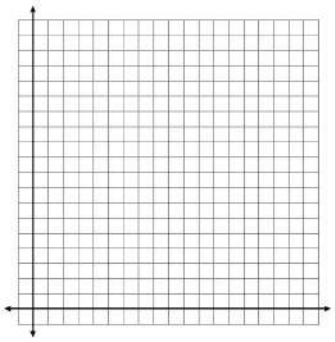
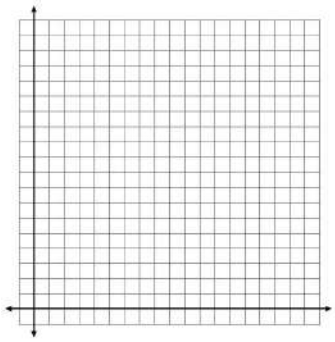
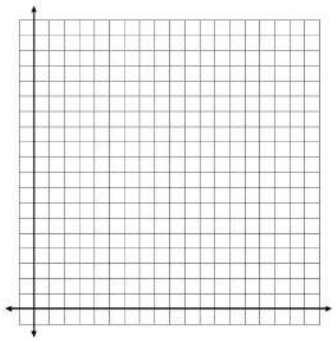
2) As m approaches infinity, what happens to T_S? Explain.

3) If m is doubled and T_S remains constant, what happens to k? Explain.

If m is doubled and T_S remains constant, then k must have doubled as well. In algebra, whatever you do to one side you must do to the other. If T_S is remaining constant, then it is essentially being multiplied by 1. In order to have one on the other side, the 2 in front of the m must be canceled out by a 2 in front of the k. In the equation below, you can see that if m is doubled and k is doubled then T_S remains unchanged.

4) If m is tripled and k remains constant, what happens to T_s ? Explain.

5) On the graphs below, sketch[1] the following graphs to show the relationships. Label each axis with the correct variable and units. When a graph is written in the form y vs. x, the first term should go on the y-axis.

T vs. m	T vs. k	T^2 vs. m
		

6) Rearrange the equation above to solve for k.

7) Rearrange the equation above to solve for m.

[1] A sketch means that you should not plot exact values, but rather just a line or curve to show the relationship between two variables.

Section II

The equation relating the variables R , ρ, l, and A is shown below.

$$R = \frac{\rho \ell}{A}$$

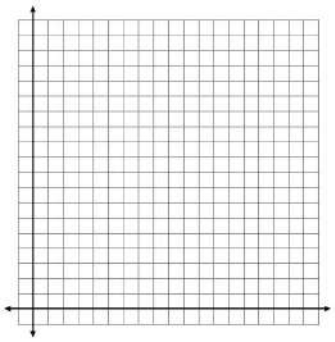
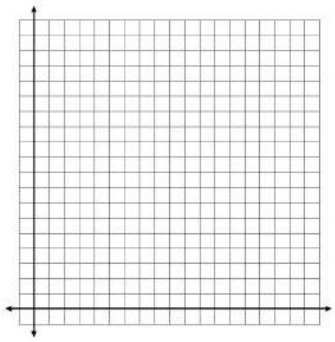
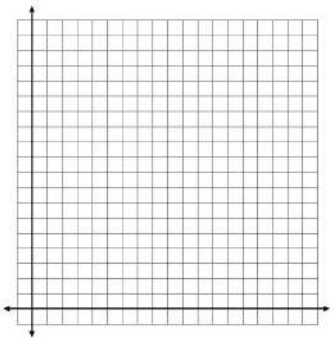
1) As A gets larger, what happens to R ? Explain.

2) As l gets larger, what happens to R ? Explain.

3) If ρ is doubled while l and A remain constant, what happens to R ? Explain.

4) If ρ is tripled, l is tripled, and A is tripled, what happens to R ? Explain.

5) On the graphs below, sketch the following graphs to show the relationships. Label each axes with the correct variable and units. When a graph is written in the form y vs. x, the first term should go on the y-axis.

R vs. L	R vs. ρ	R vs. A
		

6) Rearrange the equation above to solve for *A*.

7) Rearrange the equation above to solve for *l*.

Section III

The equation relating the variables a_C , *v*, and *r* is shown below.

$$a_c = \frac{v^2}{r}$$

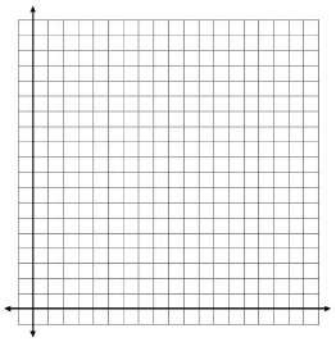
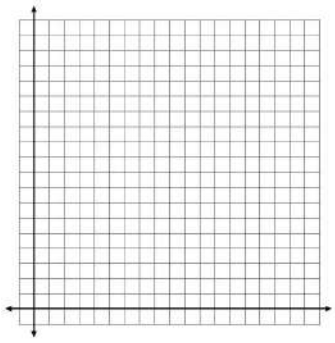
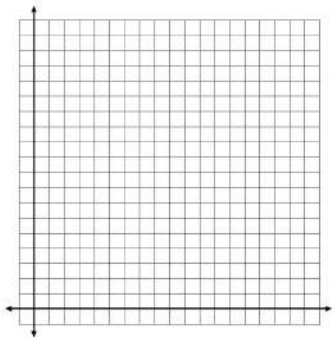
1) As *r* gets larger, what happens to a_C ? Explain.

2) As *v* gets larger, what happens to a_C ? Explain.

3) If *v* is doubled while *r* remains constant, what happens to a_C ? Explain.

4) If r is tripled, while v remains constant, what happens to a_C ? Explain.

5) On the graphs below, sketch the following graphs to show the relationships. Label each axes with the correct variable and units. When a graph is written in the form y vs. x, the first term should go on the y-axis.

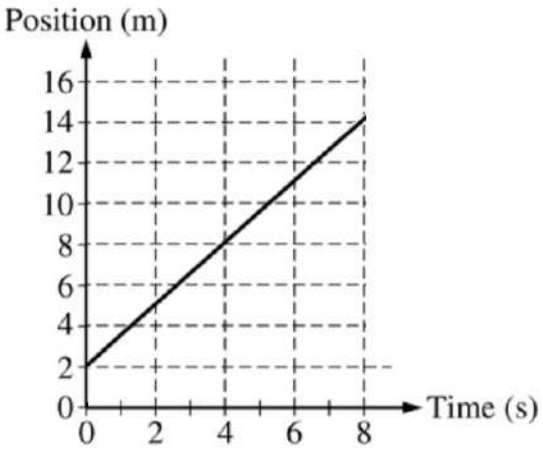
a_C vs. v	a_C vs. v^2	a_C vs. r
		

6) Rearrange the equation above to solve for r.

7) Rearrange the equation above to solve for v.

Part 5: Graphing Skills

The graph to the right shows the position vs. time of a student walking on a straight horizontal path in gym class.



1) What is the slope of this line?

2) What are the units of the slope?

3) Write the equation for this line in slope-intercept form.

The video in this link shows a student accelerating on a cart using a fire extinguisher. Your task is to collect data for the student's position as a function of time. If you pause a YouTube video, you can advance the video by one frame by pressing the 'period' button and go back one frame by pressing the 'comma' button. You must collect 20 pieces of data for the student's position and use the same part of the student for each of your measurements. You must be logged in to your htps.us account to view the video.

Frame	Time (s)	Position (m)

1) On the following page, create a hand-drawn graph that show the student's ***Position vs. Time.*** When a graph is written as *y vs. x* the first term should be plotted on the y-axis and the second term on the x-axis.
2) Each axis needs to be correctly labeled with units.
3) Your graph needs to be scaled correctly, with each grid representing the same value.
4) Your graph should include a trendline that does not connect the points, but shows the trend in the data. If the data shows a linear trend, draw a linear trendline. If the data shows an exponential trend, draw a parabolic trendline.
5) Making college level graphs is a skill that an AP Physics 1 student should find easy and is a required skill to enter this course.