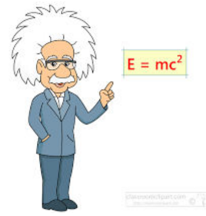
AP PHYSICS 2
Mrs. Yevick



Welcome to AP Physics 2 at Berman Hebrew Academy!

In preparation for the upcoming school year, this packet and the required work within it will hopefully help with the following:

I. Orient you as to what an AP course is, what topics the AP Physics 2 exam will cover, what kinds of questions there are and how it will be graded.
II. Help you sharpen up some necessary physics skills so you are ready to dive in in September!
III. Watch a screencast and start part of a problem set for the Thermodynamics Unit so we are not so pressed for time as we move through this year's material, which is significantly more than you covered in AP Physics 1.

Please do this entire packet by hand (not digitally) with a pencil or pen (65 points). The other 10 points will be for showing me your laminated/protected equation sheets and a big 3 ring binder with some lined and some graph paper, or other acceptable notebook designated for this class that you will bring every day.

If you have any problems, e-mail me at yevicks@mjbha.org.

NAME: ____

Part 1: What is AP Physics 2?

Check out the College Board AP Physics 2 site at the following link:

AP Physics 2: Algebra-Based

The AP exam for this course will be on __________________.

1. Go to the AP Physics 2 Course and Exam Description. You can find it with this link or linked in the topic "Important Materials" on our Blackbaud page.

2. Go to page 19 of pdf (12 at bottom of the page). In this table, there are 3 science practices that you will be expected to master in the course. **List these practices here and briefly describe each one.**

Practice 1:

Practice 2:

Practice 3:

3. On page 21 of pdf (14 on bottom of actual page), there is a table of the Units (they are now considering these a continuation of the now 8 units in AP 1!) we will be covering and the relative percentage of each that will appear on the MC portion of the exam. Please fill in the table below with that info:

UNIT	EXAM WEIGHTING
Unit 9:	
Unit 10:	
Unit 11:	
Unit 12:	
Unit 13:	
Unit 14:	
Unit 15:	

4. The largest chunk of this document between pages 19-153 contains a listing of the Content Areas (Units) that we will be covering and the individual learning objectives for each unit. Feel free to check them out. They will be helpful when you are studying to see if you know what you should know for the exam.

5. Go to page 196 of the pdf (189 at bottom of page). Read "Exam Overview."
Fill in the following table, using the info in the first two columns to calculate the third (assume equal times for each question):

Section	Number of Questions	Total Time Allotted for Section (min)	Time for Each Question (min)
Multiple Choice			
Free Response			Varies 20-25 min

10. On pages 198-199 (191-192 at bottom of page), take a look at the percentages of different science practices on your exam. Then list the four types of free response questions that will be on your exam in the following table:

Question Type	Point Value	Time Allotted (min)	Brief Description
MATHEMATICAL ROUTINES			
TRANSLATION BETWEEN REPRESENTATIONS			
EXPERIMENTAL DESIGN AND ANALYSIS			
QUALITATIVE/QUANTITATIVE TRANSLATION			

11. PRINT EQUATION SHEETS: Go to pp 235-238 of pdf (228-231 in page numbers). Please print all 4 pages of information/equation sheets. (You should end up with 2 pages, if you make them 2-sided.) **Please get them laminated or put them in a clear protective cover** and have them with you in your binder every day at school. This will count as 5 points of your summer assignment so be sure to have them with you on day 1 of class! Your equation sheet will become your best friend. **You must bring this to class every day. You will use this in every class, on every quiz, on every test, and for every homework assignment**. You may NOT write on it under any circumstances. This is the same equation sheet that will be provided to you on the real AP exam, and I want you to be as familiar with it as possible so that you can find things on it quickly.

Part II: Physics 1 Review

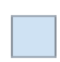
Please show all of your work, including diagrams and equations for the following problems:

1. A car travels in a straight line at a uniform speed of $\boldsymbol{v_c}$ for a time interval $\boldsymbol{t}$. The car then decelerates to a stop over the next $\boldsymbol{t}$ seconds . Derive an expression for the displacement of the car during this entire time period. Express your answer in terms of given variables.

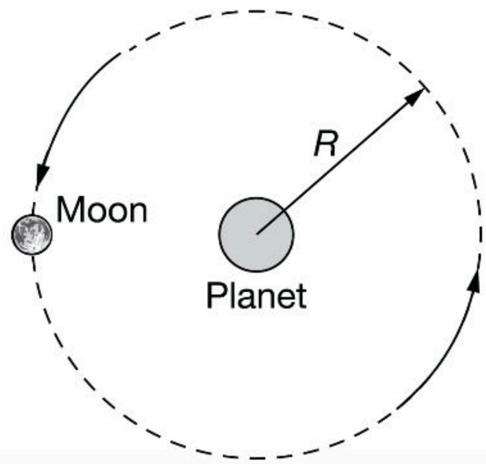
2. A 5.9 kg wooden box is pulled across a wooden floor at a constant acceleration of 1.2 m/s/s by a rope angled at 38° above the horizontal. The coefficient of kinetic friction for wood on wood is .20. a.

a. Is the normal force on the box greater than, less than or equal to the weight of the box? Explain your answer without using equations.

b. Draw a free-body diagram for the box on the diagram below. Do not include components.



c. Calculate the tension in the rope.

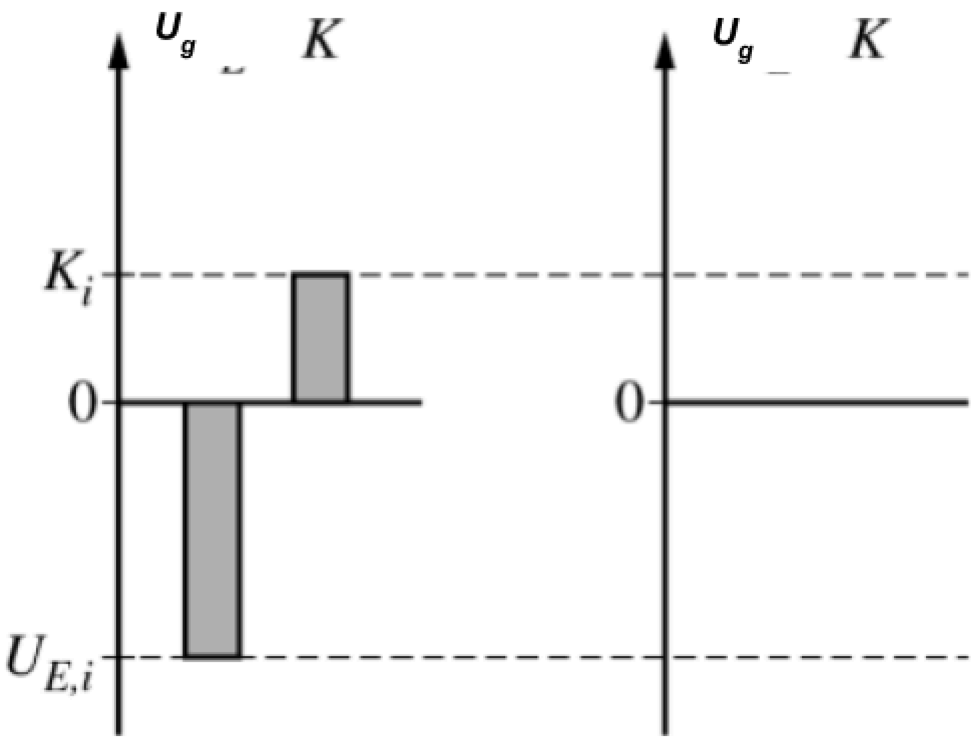


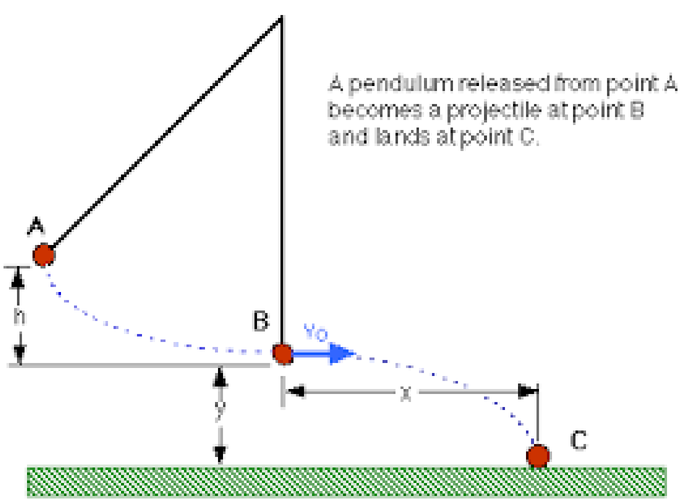
3. A moon of mass m_0 orbits a planet of mass m_p in a circular path at a distance R from the center of a stationary planet.

a. Derive an equation for the tangential speed of the moon in terms of given variables and physical constants, as appropriate.

b. Derive an equation for the total mechanical energy of the planet-moon system in terms of given variables and physical constants, as appropriate.

c. If the bar graphs on the left show the potential and kinetic energy of the planet-moon system for the moon orbiting at ***R***, sketch in the bars for a similar (masses are the same!) planet-moon system but with the moon orbiting at a distance ***2R*** instead of ***R***.





4. A 1.0 kg bob hanging from a 30 cm string is pulled back to point A and released. At point B, the string is cut and the bob becomes a projectile, eventually landing at point C. Drawing is NOT to scale!

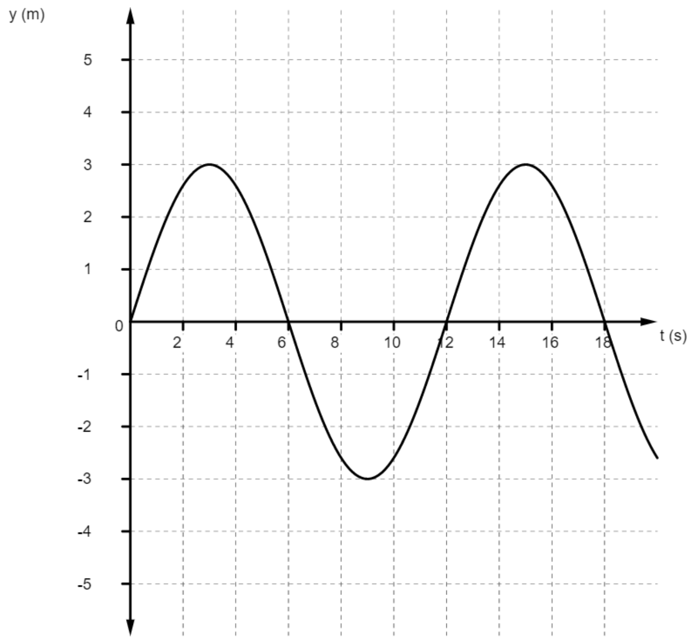
a. If the tension in the string (right before it is cut) at point B is 22 N , calculate the height difference ***h*** between points A and B.

b. If the bob horizontal range ***x*** of the projectile is equal to 67 cm, calculate the height difference ***y*** between points B and C.

5. A 60 kg crate is lifted 14 meters by a winch over a period of 4.2 s.

a. How much power did the winch generate?

b. Was the work done by gravity on the crate positive or negative? Justify your answer.

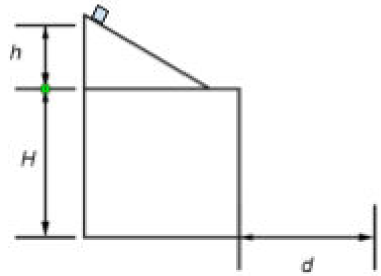


6. The graph above shows the vertical position (***y***) in meters versus time (***t)*** in seconds for an oscillating particle.

a. What is the period of the particle's oscillation?

b. What is the amplitude of the oscillation?

c. Write an equation that describes the position of the particle as a function of time.



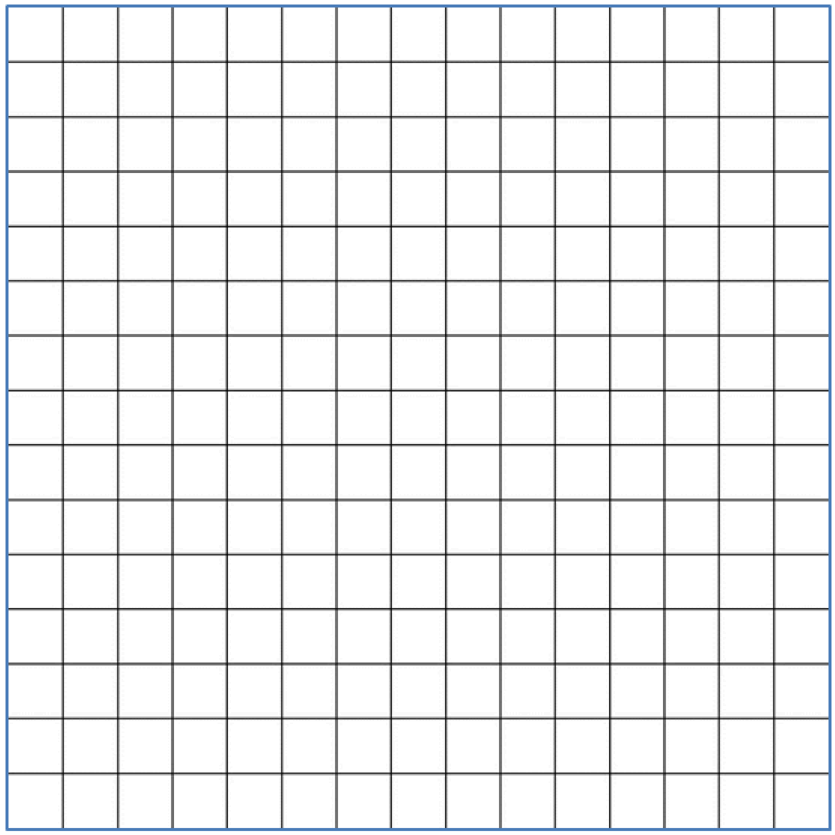
7. A student releases a block from rest from different vertical heights (h) on a smooth incline above the table top as shown above. The block slides down the ramp, then briefly slides horizontally across the smooth surface of the lab table of constant vertical height H cm before it is launched off the edge of the table. It then hits the ground a horizontal distance (d) away from the base of the table.

The student hypothesizes that the horizontal distance (d) that the block lands from the table base is directly proportional to the height (h) above the table top.

The student's data is shown below:

Vertical Distance h above table top (m)	**Horizontal Distance d from table base (m)**	
.050	.218	
.062	.246	
.071	.263	
.078	.277	
.120	.343	
.230	.474	
.300	.542	

a. On the grid below, graph the students data to see if his hypothesis is correct. Draw a best- fit line.



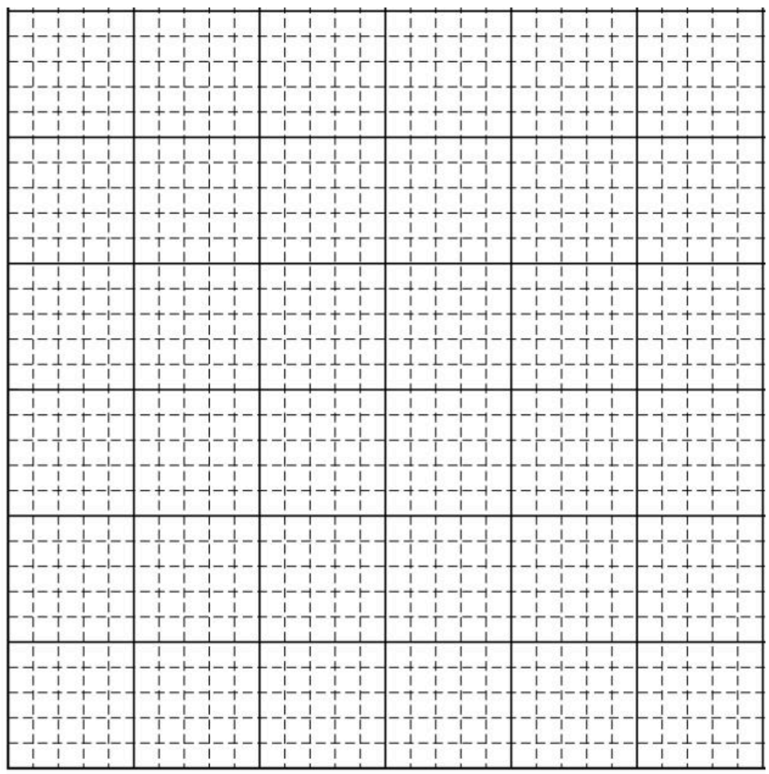
b. Was the student's hypothesis correct? Justify your answer, referring to specific features of the graph.

c. Derive an expression for the horizontal distance ***d*** in terms of ***H, h*** and universal constants.

d. Using your derived equation as a guide, which quantities could the student graph to obtain a straight line, the slope of which would yield an experimental value for the table height H?

y axis: ___________ x-axis: ________________

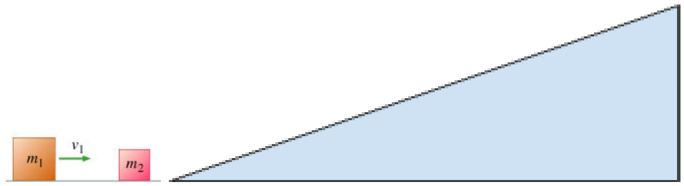
e. Using the blank columns in the data table above, create a calculated column to allow you to straighten the curve. Then graph the appropriate values below.



f. What does the slope of your line mean?

g. Use your slope to find an experimental value for the table height.

h. The height of the table the student predicted was shorter than the actual table. Explain some physical reasons why this discrepancy might arise.



8. A block with a mass of $\boldsymbol{m_1}$ is sliding without friction on a flat surface at a speed $\boldsymbol{v_1}$ when it collides with a small block of mass $\boldsymbol{m_2}$. The two blocks stick together and then encounter a frictionless ramp, as shown above. Express all answers in terms of given variables and fundamental constants.

a. Derive an expression for the velocity of the two-block system when it first encounters the ramp.

b. Derive an expression for the vertical height $\boldsymbol{h}$ that the two blocks achieve on the incline.

c. If $\boldsymbol{v_1}$ is doubled and $\boldsymbol{m_2}$ was doubled, would the value of $\boldsymbol{h}$ increase, decrease or stay the same? Explain your answer.

Part III: Unit 9: Intro to Pressure

Watch the screencast at this link and then answer the questions below:

1. A 65 kg person stands on top of the snow.

a. If their sneakers are approximated as rectangles of length 24 cm and width 11 cm, calculate the maximum force (standing on 1 foot!) and pressure that each foot could apply to the snow.

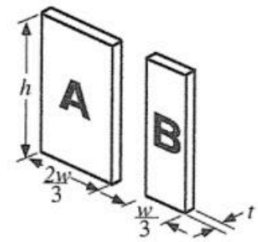
b. If the person puts on snowshoes that approximate rectangles that are three times as long and twice as wide, what is the maximum force and pressure that each foot could apply to the snow?

2. What is the weight of 2.8 m^3 of granite? ($\rho_{granite}$=1463 kg/m^3)

3. What is the mass of air in a living room with dimensions 6.2 m x 7.7 m x 3.9 m? (ρ_{air}=1.225 kg/m^3)

4.

A block of material with a width w, height h, and thickness t has a mass of M_o distributed uniformly throughout its volume. The block is then broken into two pieces, A and B, as shown. Three students make the following statements:



Ajay: *"They both have the same density. It's still the same material."*

Ben: *"The density is the mass divided by the volume, and the volume of B is smaller. Since the mass is uniform and the volume is in the denominator, the density is larger for B."*

Chithra: *"The density of piece A is larger than the density of piece B since A is larger; thus it has more mass."*

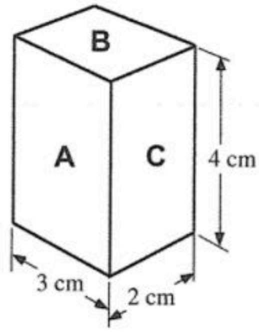
With which, if any, of these students do you agree?

Ajay _____ Ben _____ Chithra _____ None of them_____

Explain your reasoning.

5.

A rectangular block is at rest on a table. Three faces of the block are labeled A, B, and C. Face A has dimensions 3 cm x 4 cm; face B has dimensions 2 cm x 3 cm; and face C has dimensions 2 cm x 4 cm.



Rank the pressure exerted by the block on the table when it is resting on each labeled face.

1 Greatest	2	3 Least	OR	All the same	All zero	Cannot determine

Explain your reasoning.

6. A 350 N wood table rests on 4 legs. Each leg is 78 cm tall and 4 x 4 cm square. Calculate the pressure exerted on the floor by the table.

7. What is thermodynamics?

8. Fill in the following table with the different types of "thermal energy".

Quantity	Symbol	Definition
	K_{avg}	
	U	
	Q	

9. Name the 3 modes by which heat is transferred.

10. List the different waves in the electromagnetic spectrum, from least energetic to most energetic.