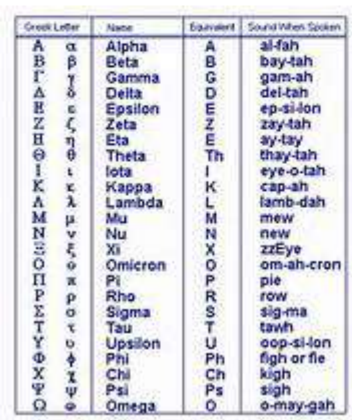
AP Physics 2 Summer Assignment

Note from Mr. Golden:
Take some time to think about these problems and to work them/learn them. I recommend one problem at each sitting, spending maybe an hour or so each. Develop some favorite online references you can use to remind you of concepts. #1 is just preliminary stuff, #2 emphasizes graphing concepts, #3 combines several concepts in a single problem, and #4 is a lab-based problem with graphing. Be sure to give adequate length and thought to the explain/justify/describe type answers. I left space where I could, but use extra paper if needed. Don't stress, but do your best and answer each one.

1. Preliminaries:

a. Greek alphabet. Memorize the Greek alphabet—seriously, read and say the names out loud and practice drawing the upper and lower case letters.



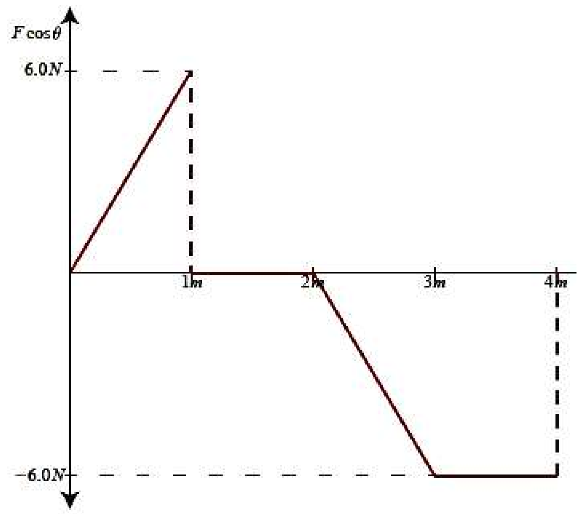
Greek Letter	Name	Equivalent	Sound When Spoken
Α α	Alpha	A	al-fah
Β β	Beta	B	bay-tah
Γ γ	Gamma	G	gam-ah
Δ δ	Delta	D	del-tah
Ε ε	Epsilon	E	ep-si-lon
Ζ ζ	Zeta	Z	zay-tah
Η η	Eta	E	ay-tay
Θ θ	Theta	Th	thay-tah
Ι ι	Iota	I	eye-o-tah
Κ κ	Kappa	K	cap-ah
Λ λ	Lambda	L	lamb-dah
Μ μ	Mu	M	mew
Ν ν	Nu	N	new
Ξ ξ	Xi	X	zzEye
Ο ο	Omicron	O	om-ah-cron
Π π	Pi	P	pie
Ρ ρ	Rho	R	row
Σ σ	Sigma	S	sig-ma
Τ τ	Tau	T	tawh
Υ υ	Upsilon	U	oop-si-lon
Φ φ	Phi	Ph	figh or fie
Χ χ	Chi	Ch	kigh
Ψ ψ	Psi	Ps	sigh
Ω ω	Omega	O	o-may-gah

b. Powers of 10 prefixes—KNOW THEM! Practice reading and saying these attached to dimension names. (millimeter, mm, and so on). Here are the metric prefixes you are likely to see this year:

tera- (T)	10^{12}	1 trillion
giga- (G)	10^{9}	1 billion
mega- (M)	10^{6}	1 million
kilo- (k)	10^{3}	1 thousand
centi- (c)	10^{-2}	1 hundredth
milli- (m)	10^{-3}	1 thousandth
micro- (μ)	10^{-6}	1 millionth
nano- (n)	10^{-9}	1 billionth
pico- (p)	10^{-12}	1 trillionth

c. Review AP Physics 1 Material: Newtonian Mechanics, Rotary Motion, Circuits

2. A net force (Fcosθ) acts on an object in the x-direction while moving over a distance of 4 meters along the axis, depicted in the graph at right.



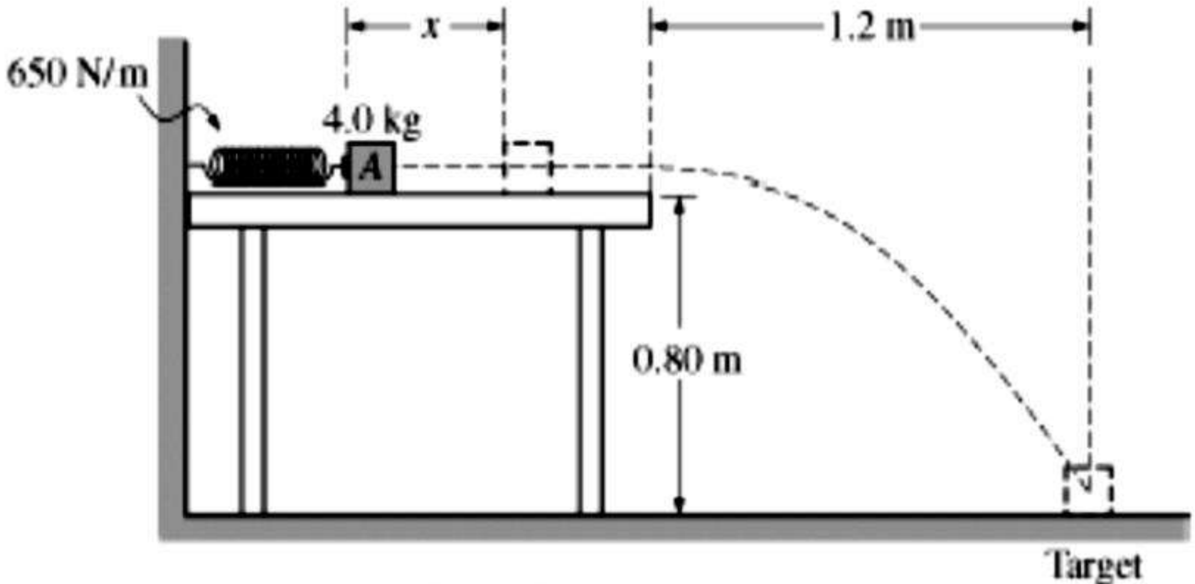
(a) Find the work done by the force in the interval from 0.0 to 1.0 m.

(b) Find the work done by the force in the interval from 1.0 to 2.0 m.

(c) Find the work done by the force in the interval from 2.0 to 4.0 m.

(d) At what position(s) is the object moving with the largest speed? Explain your answer.

3.



Note: Figure not drawn to scale.

Block *A* of mass 4.0 kg is on a horizontal, frictionless tabletop and is placed against a spring of negligible mass and spring constant 650 N/m. The other end of the spring is attached to a wall. The block is pushed toward the wall until the spring has been compressed a distance *x*, as shown above. The block is released and follows the trajectory shown, falling 0.80 m vertically and striking a target on the floor that is a horizontal distance of 1.2 m from the edge of the table. Air resistance is negligible.

a) Calculate the time elapsed from the instant block *A* leaves the table to the instant it strikes the floor.

b) Calculate the speed of the block as it leaves the table.

c) Calculate the distance *x* the spring was compressed.

Block *B*, also of mass 4.0 kg, is now placed at the edge of the table. The spring is again compressed a distance *x*, and block *A* is released. As it nears the end of the table, it instantaneously collides with and sticks to block *B*.
The blocks follow the trajectory shown in the figure below and strike the floor at a horizontal distance *d* from the edge of the table.

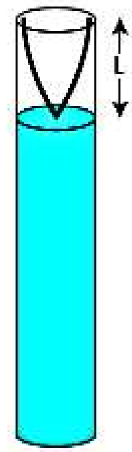
d) Calculate *d* if *x* is equal to the value determined in part (c).

e) Consider the system consisting of the spring, the blocks, and the table. How does the total mechanical energy *E*2 of the system just before the blocks leave the table compare to the total mechanical energy *E*1 of the system just before block *A* is released?

____ $E2 < E1$ ____ $E2 = E1$ ____ $E2 > E1$ Justify your answer.

4. (aka #8) Note that the water doesn't participate in the resonance except to act as a rigid reflective barrier whose position can be varied.

8. Students are attempting to determine the speed of sound in air using tuning forks and tubes which are closed at one end. In this procedure, the tube is filled with water, and a tuning fork of known frequency is struck. The vibrating tuning fork is then held over the tube filled with water, and the water is slowly drained out of the tube while students listen for the loudest possible sound at the first resonant condition. Once the loudest possible sound is heard (the first harmonic), the distance from the top of the tube to the water's surface (L) is measured and recorded. This procedure is repeated for five tuning forks of varying frequencies. Data is recorded in the table below.

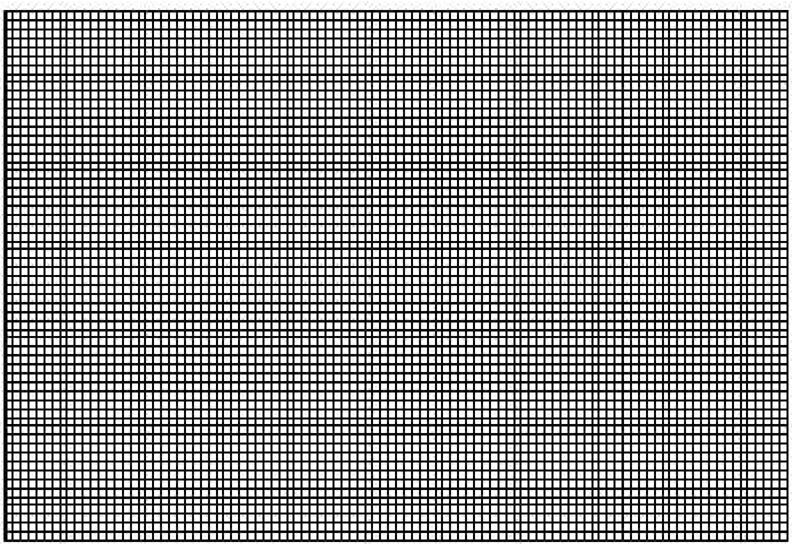


Trial	1	2	3	4	5	6
Freq (Hz)	128	256	288	384	426.6	512
Period (s)						
L (m)	.65	.33	.29	.23	.19	.17
λ (m)						

(a) Determine the period of oscillation (T) for each of the five trials and fill in the data table above.

(b) Write an equation for the wavelength of the sound wave (λ) as a function of L.

(c) Use the grid below to plot a linear graph of wavelength (λ) as a function of period (T). Use the empty boxes in the data table to record any calculated values you are graphing. Label the axes as appropriate.



(d) Draw a best-fit line on your graph. Using your best-fit line, determine the speed of the sound waves in air.

(e) Describe how your procedure and analysis would change if you used the third harmonic instead of the first harmonic to determine the speed of sound. Indicate specifically any changes in calculations.