Problem Set #1, PHYS 121, Schwartz, Due the beginning of class, Monday, January 13.
***Please let me know if you find some mistake in the text (or a video), or if there is something that is confusing the way it is written. I appreciate any feedback that will improve the material for everyone*.

Please read text/work book sections 1.0 – 1.6. The link to the book is on the main class website. However, I will give you a hardcopy on the first day of class. While you are reading, please address the exercises. In particular, please do and hand in the following:

1. Exercise 1 in section 1.0, Describing your Problem-Solving Experience

2. Exercise 1 in section 1.1, fly and window collision

3. Exercise 3 in section 1.2, Solar Panels

4. Exercise 4 in section 1.2, Energy Bar Bicycling

5. Please just read exercise 1 in section 1.3, Pushing off a boat.

6. Exercise 2 in section 1.4, Rocket speed.

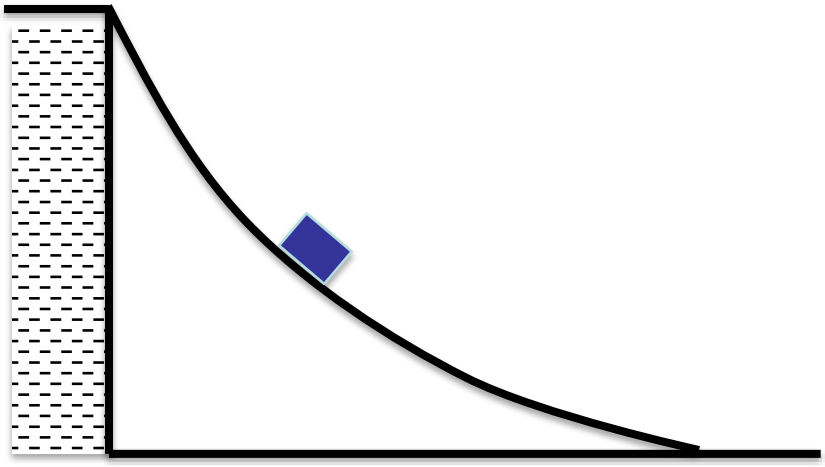
7. Exercise 3 in section 1.4, Car Collision

8. Exercise 2 in chapter 1.5, rocket acceleration. This will be very important toward preparing you for project #1. Please make sure you understand how to do this.

9. Taken from Exercise 4 in chapter 1.5. *Please be mindful <u>to identify</u> a lens for each step*:
   You push a 1000 kg car from rest on smooth level ground. It takes you 5 s to get the car to a speed of 1 m/s.
   a) What is the car's acceleration?
   b) What is the force you are exerting on the car?
   c) How does this force compare with the force of gravity on your body?
   d) Please imagine doing this in your mind. Does this sound reasonable?

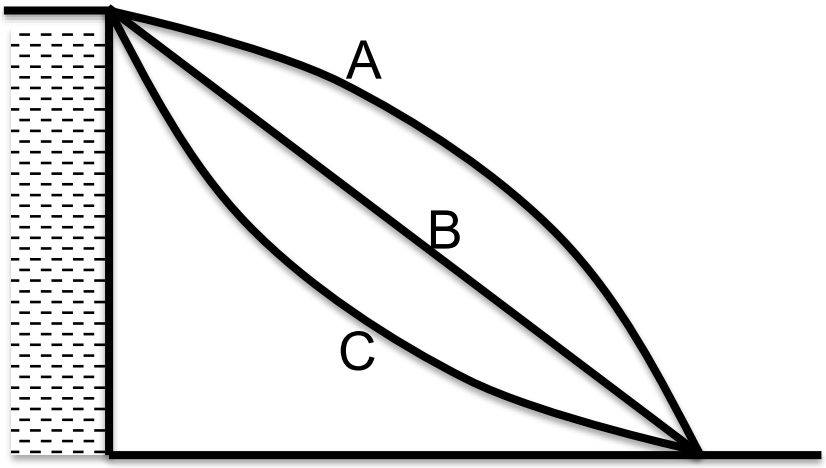
10. Please read through exercise 8 in 1.6. What does this tell you about conservation of energy versus conservation of *<u>kinetic</u>* energy in a collision?

12. Imagine a 5 kg box sliding down a frictionless curved track at the edge of a 60 m high cliff as shown at right. We would like to know how fast it's going at the bottom. Neglect air friction.



a) Describe using each of the four lenses, what is happening in this process.
b) Which lens is the most helpful to find the final speed of the block at the end?
c) Please find out the speed at the bottom of the track.

Now imagine that there are two other tracks that the box could use as shown at right, bottom.



d) Which track should we use for the fastest final speed, or would all three tracks yield the same final speed? Which lens do you look at this problem through? Please explain your answer.
e) How about if we wanted to know which was going the fastest *half way* down the total length of its path?
f) If three identical frictionless boxes were released at the top of each track, which would get to the bottom first, or would it be the same for all of them? Please explain your answer in terms of which lens you used.

13. Please do Assessment #1 in fine fashion. It is on the next page.

Assessment #1 121 Schwartz

You are taking a video of Sarah sitting in her 2000 kg car and BAM! she's hit by Michael driving a 1000 kg car. The two vehicles stick together. You catch on your video that Sarah is surprised (but unhurt) and the wreckage of the two cars moves 5 meters in the 0.5 s that you record. Michael swears he was driving only 15 m/s (~30 mph) before the collision. I'm not sure. Please estimate his speed from what you are sure of.

a) Draw a good picture of the situation.

b) What lens (or lenses) do you need for this problem?

c) What is the motivation for the lens you picked?

d) Set up equation(s) to solve the problem

e) Estimate the speed of Michael's car.

f) Reflect on your answer (does this value make sense to you?) and make sure you carried your units throughout your work