**You will be graded on your *COMMUNICATION*** of physics understanding

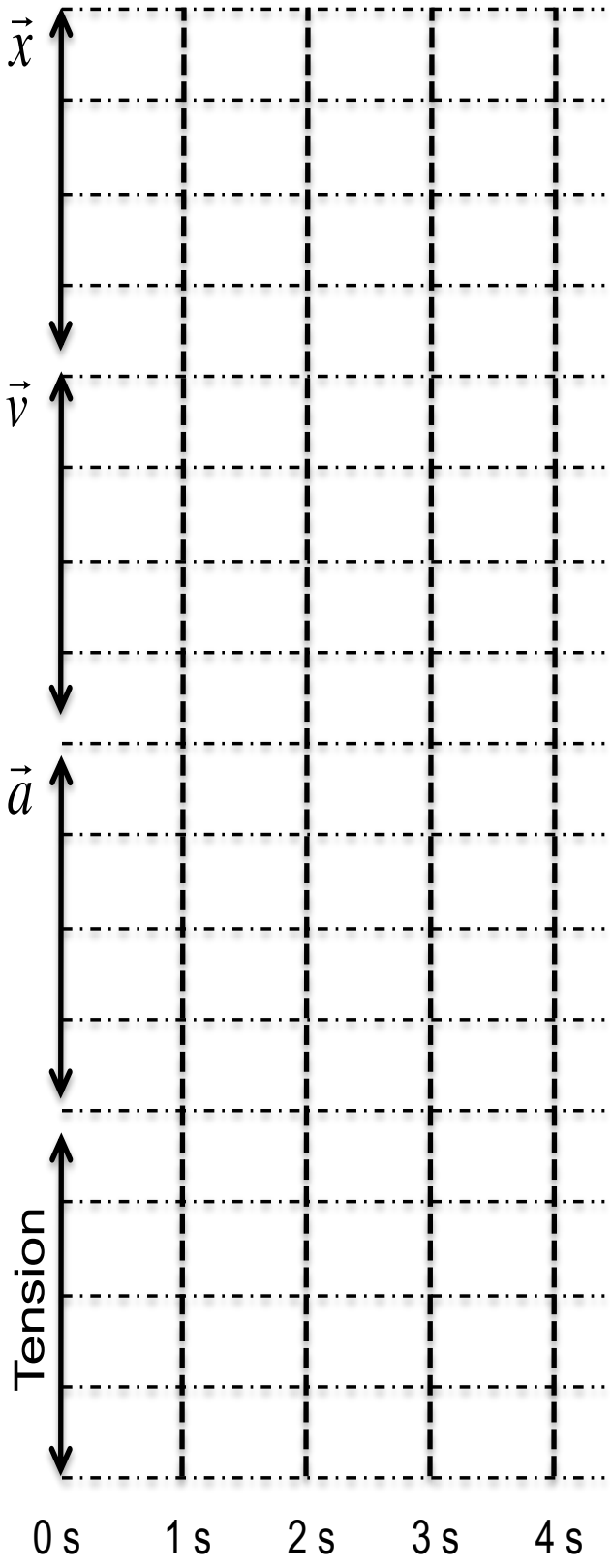
#1 You and your friends are excited to take part in the X-treme skate board challenge: Two skate boarders drop off opposite (rounded) sides of a (dry) swimming pool and stick to each other at the bottom of the pool! On the left side, a skater drops from $H_o$, while another skater with *twice the mass* drops from *half the height* from the right side. They collide in the middle.

a) After the collision, (joined together) which way are they going, or are they at rest? Of course, you know to provide a thorough explanation.

b) The left side skater is 50 kg and drops from 6 m, while the right side skater is 100 kg and drops from 3 m. Calculate the approximate final velocity of the two bodies stuck together.

c) Also calculate how far vertically up the side of the pool the two skaters will make it before stopping.

#2 Your friend is standing in a 1000 kg elevator (combined mass). At a height of 20 m, she's moving downward at 8 m/s. She continues at this speed for 1 second and then smoothly comes to rest at some height over the next 2 s. Please make the graphs describing her motion and the tension in the elevator cable during this experience. Label the axis to make the values explicitly clear. A lot of students made sign errors. I think you should decide which way is positive and check it for all calculations. Also, state your lens(es).



#3 I have a 2 kg block, bouncing between two springs as shown below. Each spring is about 1 m long and there is a 2 m low friction track in between. The spring on the left has a spring constant twice as large as that on the right: $k_L = 2k_R$.

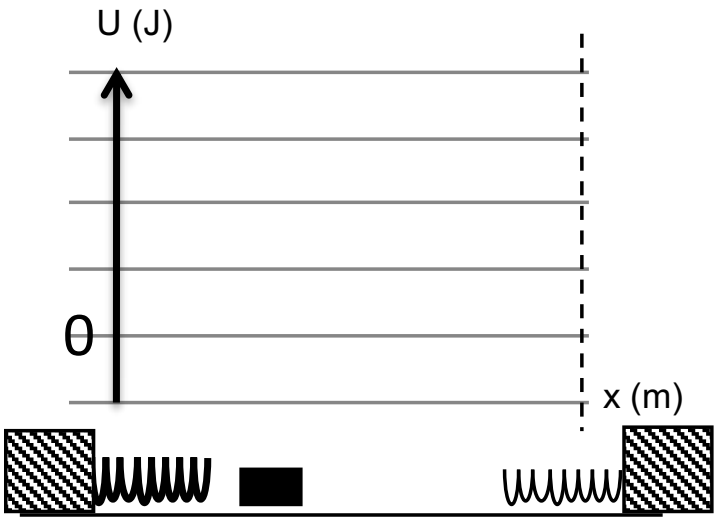
a) I compress the spring on the left and use it to launch the mass across the low friction floor into the spring on the right. How far does the right spring compress? That is: $\Delta x_R =$ ?? $\Delta x_L$. Show work.

b) Above the image below, please make a potential energy diagram, showing the potential energy of the block as a function of displacement. I'm just looking for the shape. You can't put scales on the axis because I don't give you the required constants.

*For (c) and (d) below*, what if the floor is *not* frictionless? What if there is a 2 m section of floor that has a coefficient of friction of 0.3 with the block?

c) Find the acceleration of the block on this surface as it slides to the right after leaving the spring.

d) How would this friction change the calculation you did for (a) above? How would you go about finding the compression in the second spring now? Please explain and set up the equation(s) necessary. There is not enough information to calculate the value.



#4 Your 100 kg friend, said he ran up a flight of stairs in 4 seconds… starting from rest and still going strong at the end! You measure the stairs and note that the flight is 20 m long and rises 5 meters.
Estimate your friend's power output. State any assumptions you make in the process. There need to be considerations for both kinetic and potential energy for full credit. You should state the assumptions (simplification) you make for the motion.

Name _____