Problem Set #3 due beginning of class, Monday Oct. 2. Please state the lens you are using and why. Remember that you are graded on your ***communication*** of physics understanding.

1. *not a true story.* On your trip to Dubai, you visit the tallest building in the world** and select the "extreme" elevator. Near the end of the assent, you find yourself standing on the ceiling of the elevator, upside down, on your scale, which reads 100 N. This is surprising to you because your mass is 50 kg.
   a) What do you expect the scale to read when you are standing on it on the solid ground?
   b) What is your acceleration at this moment?

** https://en.wikipedia.org/wiki/Burj_Khalifa

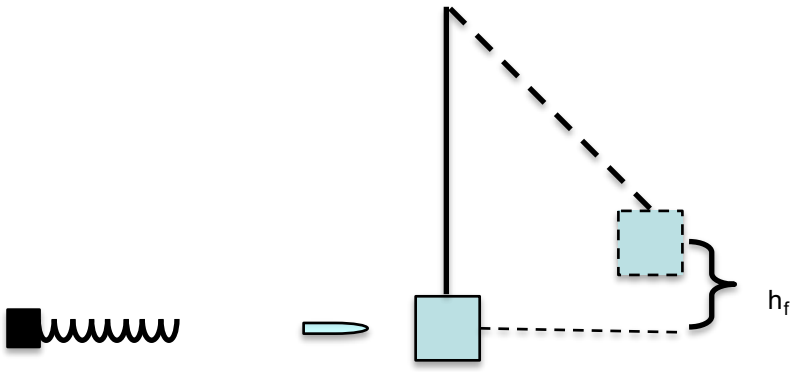
2. *From an old midterm. Even if you've never heard of fusion, you have the basic skills to draw a picture and analyze this problem.* Fusion is the process that powers the sun and hydrogen bombs: small nuclei are fused into larger nuclei. One fusion process involves a triton (two neutrons and a proton – recall that neutrons and protons have about the same mass) and a deuteron (one neutron and a proton) fusing to form a supercharged 5-nucleon nucleus, which gives off its energy by breaking up into a single neutron and a helium nucleus (or alpha particle) at high speeds. I want to know which of the particles gets more of the energy. Let's simplify the problem to just the explosive breakup: Protons and neutrons have the same mass, so we can think of this process as **a 5-ball cluster (in space, at rest) breaking up into one ball and a 4-ball cluster. Do the two pieces equally share the kinetic energy or does one get all or more kinetic energy?** You will be graded not on your answer, but on your reasons, drawings, and lens descriptions.

3. Exercise 1 in 2.3, Graphs of me riding my bike.

4. Exercise 5 in 2.7, potential energy graph.

5. An object starts at 10 m with a speed of 5 m/s and has an acceleration of $-4\ m/s^2 + 2\ m/s^3(t)$. Find the velocity and position after 3 seconds.

6. loaded gun is cocked by compressing a spring of $k = 10^4$ N/m. and then releasing it behind a 20 g bullet. The bullet strikes and sticks inside of a 0.5 kg ballistics pendulum and swings upward to a final height of 50 cm. Presume the spring is massless and there is no friction in the system. Please find:



   a) The bullet's speed.
   b) how far the spring was compressed.
   c) Does the bullet have constant acceleration in the gun, or does the acceleration change over time? Please explain your answer… identify a lens.
   d) Please find the maximum acceleration of the bullet in the gun.
   e) Did you identify the lenses at the very beginning, or one at a time for each question? Which do you think would be a better approach?

7. Using an energy lens, please show that if you drop a 5 kg box from 60 m, it hits the ground at ~35 m/s. But then, you *throw* the box *downward* from 60 meters height with an initial speed of 35 m/s.
   a) Find the speed that it has when it hits the ground.
   b) What if I throw it *upwards* at 35 m/s, what is the speed when it hits the ground?
   c) What if I throw it straight off the cliff at 35 m/s horizontally, what speed does it have when it hits the ground now?
   d) *Can* I throw a 5 kg box at 35 m/s? Please back up your answer.