AP/Honors HW: Forces 2

Full Name, Period, AP/Honors: **due: 11/16**

1 A 1 in 4 chance at greatness awaits

1. You hang a cow with mass M_1 from the ceiling of an elevator that is initially at rest relative to the earth using a spring. The displacement of the spring from equilibrium is Δx_1. The elevator begins accelerating upwards at a. What is the new displacement of the spring from equilibrium?

   A. Δx_1

   B. $\Delta x_1 \frac{a}{g}$

   C. $\Delta x_1 \frac{g+a}{g}$

   D. $\Delta x_1 \frac{g-a}{g}$

2. A company is attempting to hide wrongdoing from the EPA by dumping the evidence in a lake. They slide a barrel of toxic waste in the $-\hat{x}$ direction across a floor with friction coefficient μ_k. Friction is the only unbalanced force that acts on the barrel. What is the acceleration of the barrel?

   A. $\mu_k g\hat{x}$

   B. $-\mu_k g\hat{x}$

   C. $\frac{1}{\mu_k} g\hat{x}$

   D. $-\frac{1}{\mu_k} g\hat{x}$

3. (**Honors**) Springs with coefficients k_1 and k_2 are attached to opposite ends of a mass resting on a frictionless floor. The other ends of the springs are attached to walls. The mass remains at rest. If the **magnitude** of the displacement of the first spring is Δx_1 and the **magnitude** of the displacement of the second is Δx_2, which of these gives $\frac{\Delta x_2}{\Delta x_1}$?

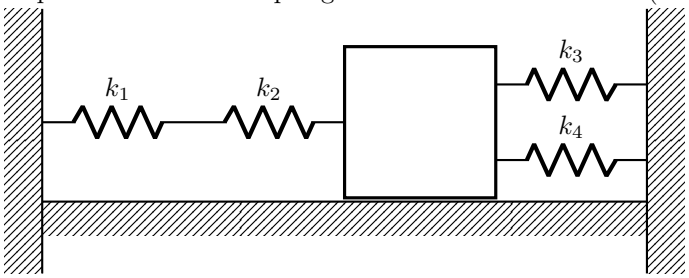
   A. $\frac{\Delta x_2}{\Delta x_1} = \frac{k_1}{k_2}$

   B. $\frac{\Delta x_2}{\Delta x_1} = \frac{k_2}{k_1}$

   C. $\frac{\Delta x_2}{\Delta x_1} = \frac{k_1^2}{k_2^2}$

   D. $\frac{\Delta x_2}{\Delta x_1} = \frac{k_2^2}{k_1^2}$

4. (**AP**) You have 4 identical springs (ie $k_1 = k_2 = k_3 = k_4$). You attach two springs end to end, then attach the ends of the newly formed longer spring to a mass and a wall. On the other side of the mass, you attach two springs each directly between the mass and the wall. The mass is not accelerating. There is no friction anywhere. See diagram below. Which of these could give the **magnitude** of the displacement for each spring? Answers are in the form $(\Delta x_1, \Delta x_2, \Delta x_3, \Delta x_4)$.



   A. $(\Delta x, 2\Delta x, \Delta x, \Delta x)$

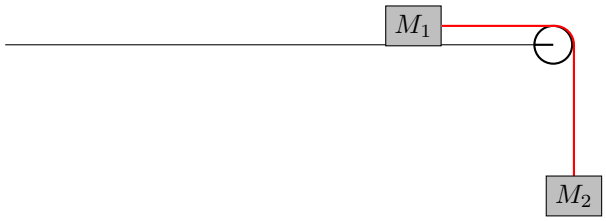
   B. $(\Delta x, \Delta x, \Delta x, \Delta x)$

   C. $(\Delta x, \Delta x, \frac{1}{2}\Delta x, \frac{1}{2}\Delta x)$

   D. $(\Delta x, \Delta x, 2\Delta x, 2\Delta x)$

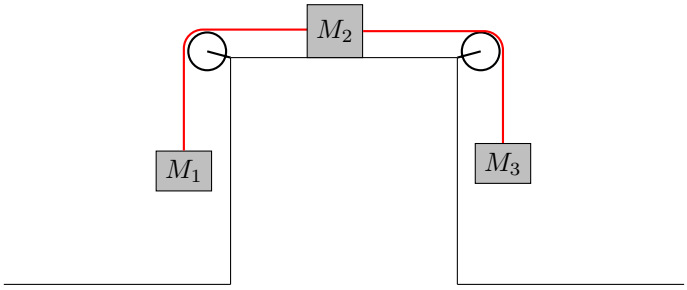
2 all those who escape the giant's pull,

Below is a system consisting of two squids with friction coefficients $\mu_s = 0.5$ and $\mu_k = 0.25$. The system is currently on Jupiter where the acceleration due to gravity is about $g_j = 24.79\ \frac{\text{m}}{\text{s}^2}$. Find the mass of the largest squid M_2 that can be hung from a squid with mass $M_1 = 34$ kg before the squids begin to fall.



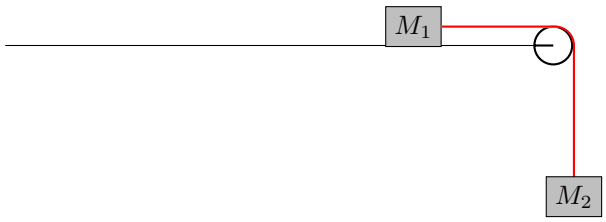
3 to solve riddles once again. At home,

1. You create the following apparatus on Earth. M_2 has a coefficient of kinetic friction of μ_k with the surface. M_2 is observed to move in the $+\hat{\text{x}}$ direction with constant velocity. Find the coefficient of kinetic friction in terms of M_1, M_2, and M_3.



4 two divergent paths remain; one we must walk.

(**All**) You build the following setup. There is no friction.



1. (**Honors**) You know the masses M_1 and M_2. If the gravity is g, what will be the acceleration of M_1 when it is released?

2. (**AP**) You have an extension only spring with known coefficient k_1 a measuring tape and a stopwatch. You know the gravity of the planet g. Explain how you would find M_1 and M_2 in terms of these variables and anything you can measure with the tape and/or stopwatch. Your explanation can be conceptual, mathematical, or some combination. You may not disassemble the apparatus, but you may attach the spring wherever you like. (hint: do two experiments, one should use the spring, and the other should use the stop watch.)

5 Poets we will never be.

(∞i, **All**) Write a poem that tells the legend of your mighty deeds in physics class. Make sure that it includes your name, your period, and your AP/Honors status.