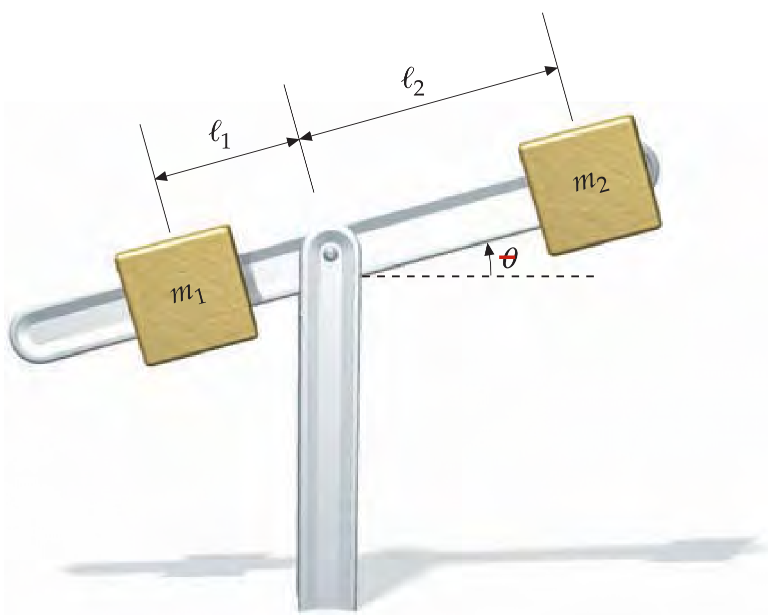
UNIT 11 HOMEWORK AFTER SESSION ONE

SmartPhysics: *View the Prelecture 9 "Work and Potential Energy II" before the class of next session and answer the checkpoint questions. (The online Homework is due the next day.)*

- *Work the following problem*

33 •• **MULTISTEP** A straight rod of negligible mass is mounted on a frictionless pivot, as shown in Figure 7-38. Blocks having masses m_1 and m_2 are attached to the rod at distances ℓ_1 and ℓ_2. (*a*) Write an expression for the gravitational potential energy of the blocks–Earth system as a function of the angle θ made by the rod and the horizontal. (*b*) For what angle θ is this potential energy a minimum? Is the statement "systems tend to move toward a configuration of minimum potential energy" consistent with your result? (*c*) Show that if $m_1\ell_1 = m_2\ell_2$, the potential energy is the same for all values of θ. (When this holds, the system will balance at any angle θ. This result is known as *Archimedes' law of the lever*.) SSM



- *Work Supplemental Problem SP11-1 listed below*

SP11-1) [20 pts] **Frames of Reference:** Different observers can choose to use different co-ordinate systems. Some observers might be moving relative to others. Some simply choose a different origin. Let's simulate the case of the devilish college president dropping a balloon on a hapless student as in Activity 11-3. You can use the movie of the ball toss for this analysis. Simply pretend that (1) the falling ball is a water balloon of mass .454 kg, and (2) the president's floor is at the highest point the tossed ball reaches. You should do the following:

(1) Use Logger Pro to examine the movie.
(2) Calibrate assuming the meter stick is 2 m long.
(3) Set the origin at the president's floor level i.e. at the top of the toss. Take data for position vs. time and save it.
(4) Reset the origin at the student's floor level (i.e. the lab floor level) and recalculate the data with the new origin.
(5) Set up spreadsheets to calculate the total energy of the balloon (potential and kinetic in each case). Be sure to use the leap-frog method for determining the velocities. See Figure 11-1.

(You don't need to submit your files on line for this problem.)

(a) What is the total mechanical energy that the president observes? Does the president see a constant total energy? (b) What is the total mechanical energy that the student observes? Does the student see a constant total energy? (d) Do they agree on the value of the total mechanical energy? (e) Do they agree that energy is conserved? Explain.

UNIT 11 HOMEWORK AFTER SESSION TWO

- *Work the next problem*
  - 46. **Frisbee** A 75 g Frisbee is thrown from a point 1.1 m above the ground with a speed of 12 m/s. When it has reached a height of 2.1 m, its speed is 10.5 m/s.What was the reduction in the mechanical energy of the Frisbee-Earth system because of air drag?

- *Work Supplemental Problem SP11-2 listed below*

SP11-2) A 5.0-kg block travels on a rough, horizontal surface and collides with a spring. The speed of the block *just before* the collision is 3.3 m/s. As the block rebounds to the left with the spring uncompressed, its speed as it leaves the spring is 2.0 m/s. If the coefficient of kinetic friction between the block and surface is 0.5, determine (a) the work done by friction while the block is in contact with the spring and (b) the maximum distance the spring is compressed.

- *Complete Unit 11 entries in the Activity Guide*